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Machine Shop

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OCTOBER, 1929

CINCINNATI, OHIO VOL. 2, No. 5

Production Operations on LeBlond Aircraft Engines

By HOWARD CAMPBELL

THE LeBlond Aircraft Engine Corporation, Cincinnati, Ohio, builds three sizes of engines—the "60," "90,' and the "120"—the type numbers also serving to designate the horsepower of the different engines. The 60- and 90-h. p. models use cylinders of the same type and size, the principal difference in the two engines lying in the use of five cylinders on the 60-h. p. size and seven on the other. Standardization of parts has been accomplished as far as possible, both to reduce manufacturing costs to the minimum and to reduce the task of servicing these engines to its simplest terms. Nearly 90 per cent of the parts used on these engines are interchangeable.

The cylinders are cast of fine grade of nickel iron, each cylinder comprising a single unit with cooling fins integral. Each cylinder is held to the crankcase by eight studs, the inner end of the cylinder barrel extending into the crankcase far enough to prevent the over-oiling of the lower cylinders. The combustion chamber is of spherical shape and provides seats for the valves, which are inclined at an angle of 30 degrees to the cylinder axis.

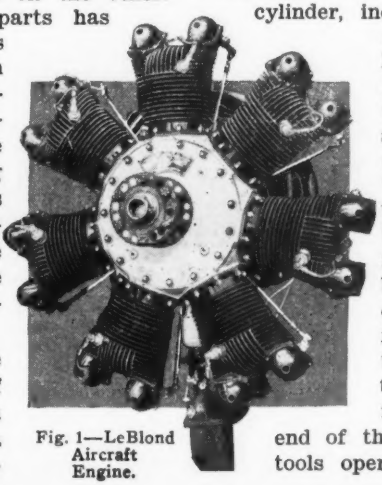


Fig. 1—LeBlond Aircraft Engine.

The operation of rough boring the cylinder, including the turning and facing of the lower end of the barrel, is performed in the turret lathe shown in Fig. 2. The cylinder is held in a "barrel" fixture which is attached to the spindle of the machine, and the boring and turning operations are performed with turret tools while a tool in the cross slide turret faces the flange and end of the barrel. The four tools operate simultaneously.

When the rough boring operation is completed, the tool shown in Fig. 3 is inserted into the cylinder and the interior of the dome is rough machined. The cutting tool is held in a flat section that is pinned in the end of the bar, as shown, and which has a rack cut in it in such manner that it can be revolved by means of a pinion on the end of a shaft. The shaft is revolved by the use of the ratchet wrench shown in place in the illustration.

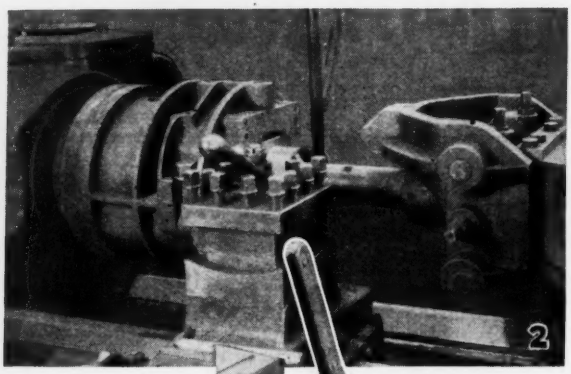


Fig. 2—Rough boring, facing, and forming the dome of the cylinder.

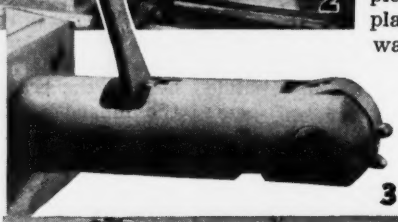


Fig. 3—Tool for machining the radial dome in the cylinder.

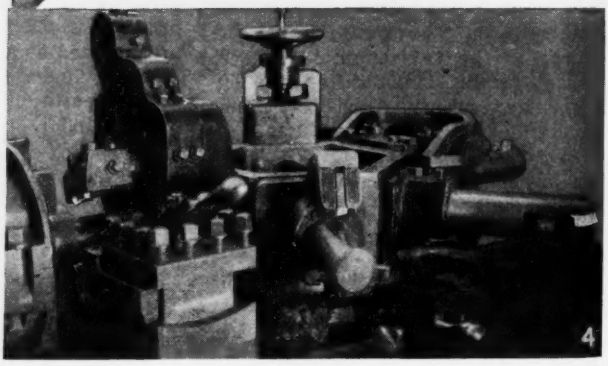
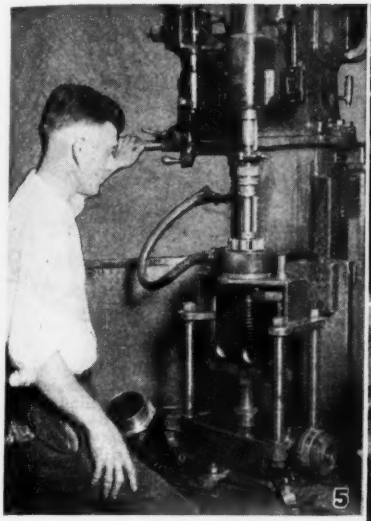
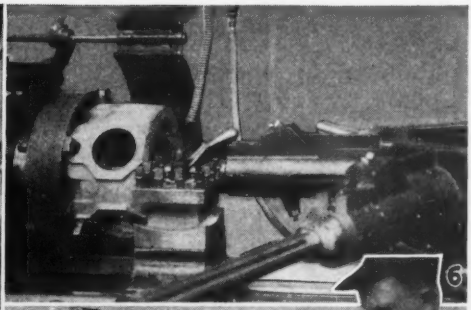


Fig. 4—Finish-machining operation on the cylinder in process.

The finish boring, turning and facing of the cylinder is performed in the same machine in which the roughing is done, using the tools shown in Fig. 4. The turret boring bar finishes the bore to 4.122 inches, leaving .003 inch for honing. While the boring is in process, turret tools finish turn the barrel and face the end, a facing and necking operation on the flange being performed by cross slide tools at the same time. The dome is then finished with the form tool shown at the right in the illustration.

Each cylinder is honed separately in the Barnes honing machine shown in operation in Fig. 5. The cylinder is held in a jig which is so constructed that the piece rests on a location plate that is forced upward by means of a vertical plunger, which in turn is operated by a cam-and-lever arrangement. By this method of locating, the open end of the cylinder can be located in exact alignment with the machine-spindle, and all cylinders will be held at the same height. A Hutto





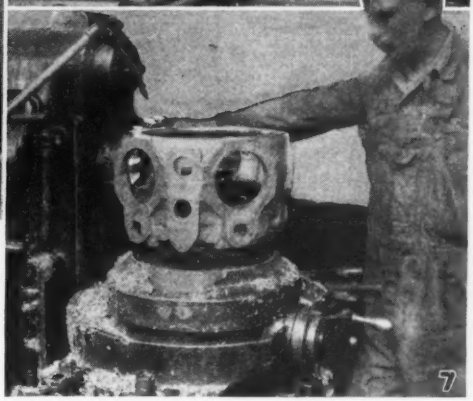


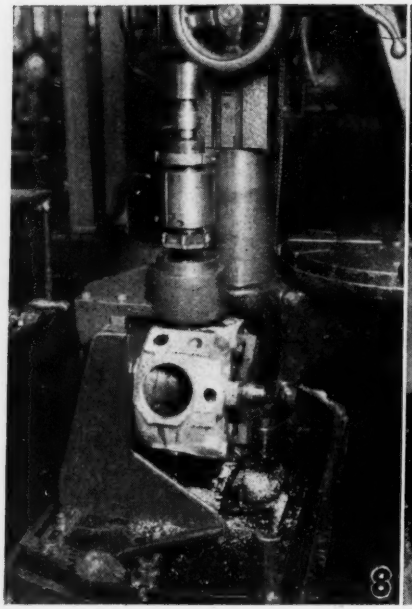
Fig. 5—This Barnes honing machine, equipped with a Hutto hone, finishes the bore within .0005 inch. Fig. 6—Boring and facing the crankcase on a turret lathe. Fig. 7—Milling the cylinder pads on the crankcase, using a LeBlond milling machine.

hone with "M4" stones is used, with kerosene as the lubricant. The cylinder is honed to size in from three to four minutes, within a limit of .0005 inch.

The crankcase is of cast aluminum alloy, heat treated to obtain the maximum of tensile strength. It has a large opening in front through which the crankshaft and connecting rods may be inserted as an assembly, this opening also serving as a pilot for the crankcase cover. A similar opening with ten studs at the rear provides for attaching the gearcase assembly. The integral inlet manifold is a separately-cored passage in the form of a ring with openings to receive the inlet pipes and one which connects with the carbureter.

The first operation on the crankcase is that of rough and finish boring and chamfering for the crankcase cover, facing the front of the case, and boring and reaming the hole in the rear end, which is accomplished in the turret lathe shown in Fig. 6. The turret boring bar carries tools which bore both diameters and chamfer, the facing operation being performed by tools in the cross-slide turret. Operating at a spindle speed of 53 r.p.m., the operation is completed in approximately 12 minutes.

The cylinder pads on the crankcase are finished with the LeBlond milling machine, shown in Fig. 7. The case is clamped to the upper plate of a fixture that is bolted to the table of the machine. A lever at the front of the fixture controls the vertical action of a plunger pin which, by entering one of the holes in the upper plate, serves to lock the piece in position.



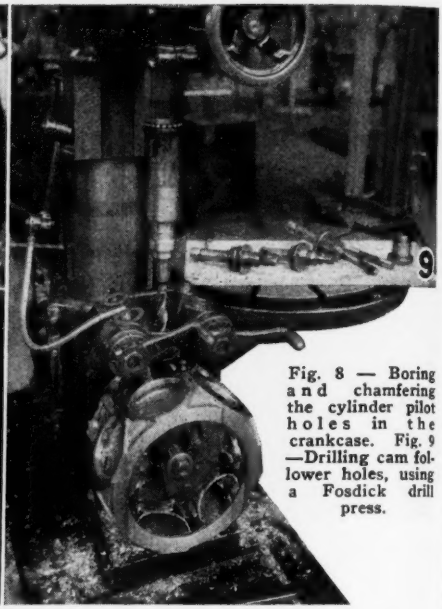


Fig. 8 — Boring and chamfering the cylinder pilot holes in the crankcase. Fig. 9 —Drilling cam follower holes, using a Fosdick drill press.

An inserted-tooth face milling cutter is used, and the pads are held to a limit of .002 inch from the center.

The tools shown set up in the Fosdick drill press shown in Fig. 8 are used in boring and chamfering the cylinder pilot holes in the crankcase. The case is held in the jig by being clamped to a revolving disc which is held in position by a locating pin that is operated by a lever. A six-flute cutter is used, operating at a speed of 150 r.p.m. and a feed of .011 inch per revolution. The hole is finished to 4.4365—4.4385 inches.

The tools used to drill, ream, spotface and chamfer the cam follower holes are shown in Fig. 9. This machine is also a Fosdick drill press. As in Fig. 8, the case is clamped to a revolving plate which is located and held in position by a plunger-pin. Two pins are provided, however, one entering the locating hole in the plate, the other entering the intake pipe hole in the case, thus insuring correct location. As there are two cam followers for each cylinder, two sets of locating pins are provided, as shown. The pins at the left locate the piece for drilling the holes at the right of the cylinder pilot hole; the pins at the right locate the piece for drilling the holes at the left. Each of the 14 cam follower holes is drilled and reamed to .875± .0005 inch.

The operation of drilling the faces of the crankcase for the cylinder and intake pipe studs is shown in process in Fig. 10. Here a 30-inch Fosdick drill press is used with a multiple drill head, providing for the close location of the ten holes and reducing the drilling time to the minimum. The piece is located by a disc attached to the under side of the jig plate, the

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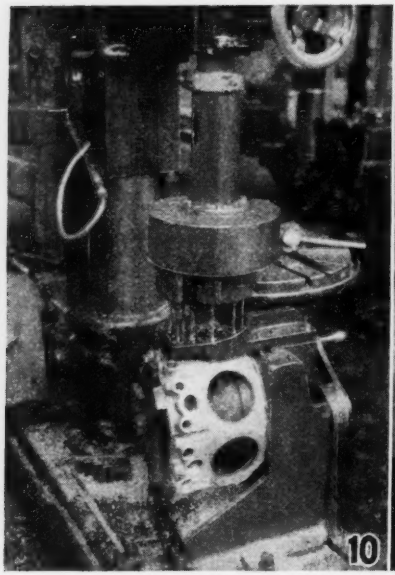

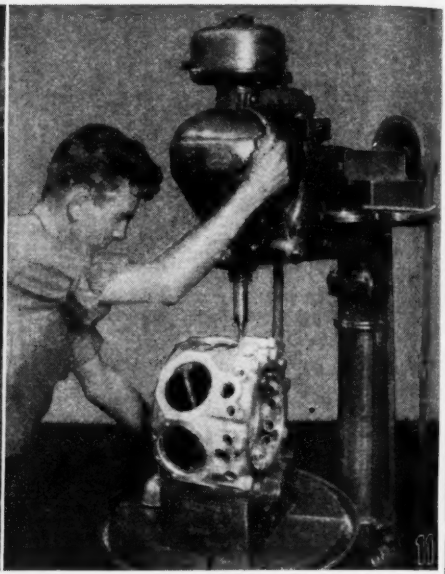

Fig. 10—Drilling the cylinder and intake pipe stud holes in the crankcase.
Fig. 11—Tapping cylinder stud holes in the crankcase.

disc fitting into the cylinder pilot hole and being controlled by the hand lever at the right.

The operator shown in Fig. 11 is tapping the cylinder stud holes in the crankcase, using a Gaterman pneumatic tapping machine.

The construction of this machine is unique in that, when the pressure against the tap, or "load" becomes heavy enough so that it is in danger of breaking the tap, the tap spindle will automatically back up a bit, allowing the tap to free itself as in hand tapping, and will then proceed again. The load possible before a tap will break is predetermined and the machine is set accordingly, after which the entire action is automatic. As the maximum of applied pressure is always the same, the crankcases are tapped at a rapid rate; no time is lost in stopping to remove broken taps.

(The second and concluding article on Le Blond Aircraft Engines will be published in the November issue.)

Hill-Curtis Co. Changes Name to Hammond Machinery Builders, Inc.

Mr. W. C. Hammond, president of the firm formerly known as the Hill-Curtis Company, of Kalamazoo, Mich., announces that as no one by the names of either Hill or Curtis has been connected with this firm for many years, and inasmuch as it seemed desirable that the firm be known by a name that would have more meaning to the trade, the firm name has been changed to Hammond Machinery Builders. The firm manufactures three distinct lines of polishing, grinding, and sawing machinery.

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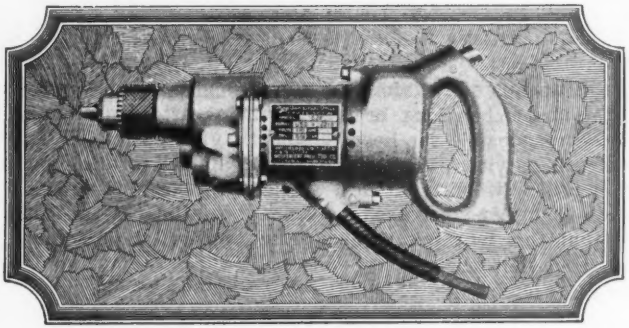

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Reclamation of Locomotive Piston Heads by Bronze Welding

By JAS. M. VOSSLER,
Welding Instructor, Southern Pacific Lines

AN economical means of reclaiming worn piston heads has long been sought by those responsible for keeping locomotives in service. With the introduction of bronze welding of cast iron by the oxy-acetylene process, it was thought that this long-felt want had been realized, but the first attempts did not meet with the desired success. This was due to the attempts to build the worn surfaces up with a soft bronze, which, it was found, would batter and then bind the piston rings. The attempt was not given up as a failure, however, but, on the contrary, the possibilities of the process were fully appreciated and a search was made to find a bronze of sufficient hardness so that it would not batter.

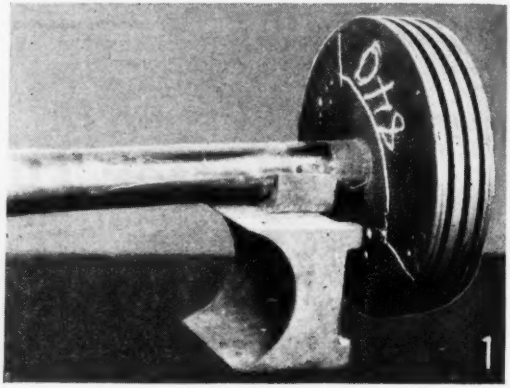

Fig. 1—Worn piston head. The limits of the worn parts are indicated by the chalk marks.

Partial success was realized by the use of a Manganese bronze welding rod, but under certain conditions, though not often, this bronze was also found to batter and bind the rings.

The difficulty was finally overcome by the use of a phosphor bronze filler rod. This bronze is much more difficult to apply, and welders inexperienced in applying it will leave it full of blow holes. Unless these blow holes are large they will not give any trouble. With a little experience in the application of phosphor bronze this difficulty is easily overcome, and the metal after turning will have a smooth, glossy surface. The condition of the applied bronze can be easily judged by examining the turnings from the lathe. If the bronze is properly applied, the turnings will curl up like turnings from a good grade of steel and will show considerable strength. Should the bronze be burnt or be too full of blow holes, the turnings will crumble at the lathe tool, with little or no curl.

After the piston heads were built up with the phosphor bronze and placed in service, it was found that the bronze-welded heads would last considerably longer than new ones, which was due to the better wearing qualities of the bronze surface as

(*Continued on page* 20)

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NEW CONVENIENCE

Welding Piston Heads

(*Continued from page* 16)

compared with the cast iron surface of a new head. In fact, a few were found to last more than twice as long. The total cost of the reclamation of a head ranged from 35 to 50 per cent of the cost of a new head, depending upon the extent to which it had been worn. The use of the bronze on the head was further beneficial in that it reduced the wear on the cylinder, due to the above-mentioned wearing qualities.

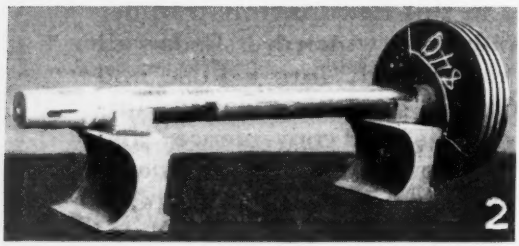

Fig. 2—Manner of supporting the piece for welding.

In Fig. 1 will be seen a piston head on which the limits of the worn surface have been marked with chalk. Naturally, the portion of the head that wears is that portion which comes in contact with the lower portion of the cylinder, and, at most, is only about forty per cent of the surface on the periphery of the head. The bronze must be made thicker at the center of the worn surface, and taper out to nothing at the ends, so as to restore the periphery of the head to its true circular shape. The bronze must be built up about one-eighth of an inch more than the true surface, to allow for machining in the lathe.

In preparation for bronze welding, the surface on which the bronze is to be applied should be cleaned, preferably by grinding with either an air or electric portable grinder. This is not absolutely necessary in all cases, but should be done to remove such deposits as are left on the surface by the cylinder oil, and thereby assist in preventing the formation of blow holes in the bronze.

As piston heads like that shown in Fig. 1 are hollow castings, and since the heat of the welding operation is likely to produce pressure within the head—especially if water or oil is present inside the head—and thus cause it to burst with a more or less dangerous explosion, care must be exercised to see that at least two holes are drilled into the hollow part. These holes will permit the escape of such vapors or gases as may exist or form. On most roads, these holes are drilled before the head is first applied.

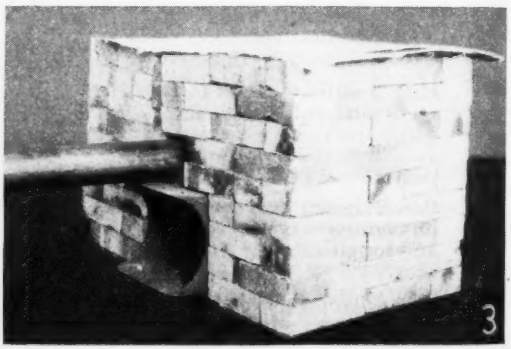

Fig. 3—The head is enclosed in a brick furnace for pre-heating. The cover is a sheet of asbestos.

The first attempts at building up the heads with bronze were made without preheating. No trouble was experienced when the soft bronze was used, but upon using manganese or phosphor bronzes, examination after the

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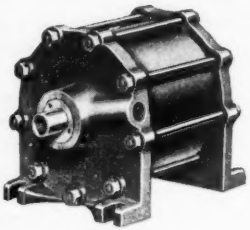
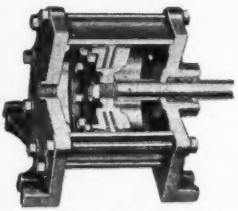


Model "B"



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weld had cooled disclosed that in some cases the walls of the ring grooves were cracked at the ends of the weld, the cracks extending to the bottom of the ring grooves. The next lot of heads that the welders were called upon to build up were given a light preheat, raising them to about 400 degrees F. After the welding was completed and the heads had cooled, examination showed no cracks in the ring groove walls. This proved that it was best to give the heads a low preheat before welding.

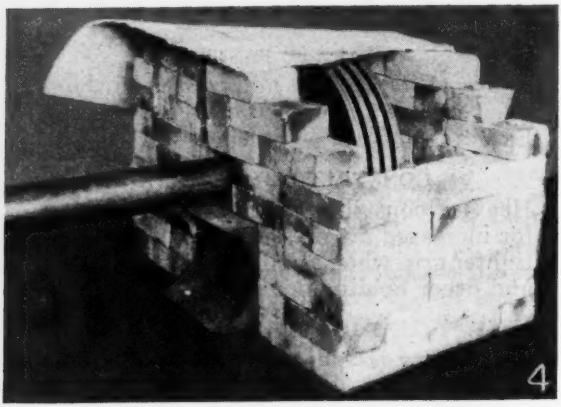


Fig. 4—Furnace with bricks removed so that the operator can get at the job.

Another advantage that is gained by preheating is due to the fact that when the heads were welded without preheating, investigation showed that the cast iron just beneath the bronze weld had become quite hard. This was most evident at the ends of the weld where the lathe tool would pass from the cast iron to the bronze, or vice versa. When the practice of preheating the heads was started, this difficulty was overcome. A considerable saving in oxygen and acetylene is also effected by preheating the piston heads, as a smaller welding flame can be used. The saving in gas will more than pay for the cost of preheating.

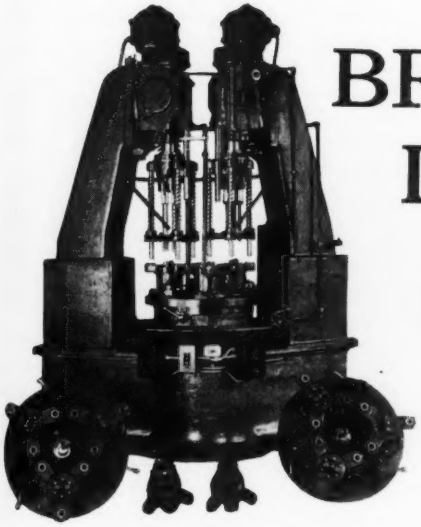
At first it was thought best to remove the heads from the piston rods, anticipating that the heat would loosen the head on the rod. Experience, however, has shown that this was a mistaken idea. The practice of removing the heads for welding has been discontinued, and since then not one head has been found loose after cooling.

The manner of supporting a piston head for welding is shown in Fig. 2. The piston rod was supported by scrap split brasses, taken from driving rods. These brasses were used to prevent scratching the surface of the rod when the head was revolved.

Fig. 3 shows the head encased in the brick preheating furnace. After the furnace is built, a charcoal fire is started beneath the head. One sack of charcoal has generally been found to be sufficient for the entire job. In most cases a considerable amount of oil will have accumulated inside of the head, and as the head heats up, this oil will gasify and burn with a flame that will shoot from 12 to 14 inches out of the holes previously drilled. When these flames have burned out, the head will be found to be hot enough to start the weld. The temperature of preheat required before the weld should be started is about 400 degrees F.

In order for the welder to get at the job, the furnace is opened as shown in Fig. 4. It has been found that the best point at which to start welding is about 45 degrees from the

For High Production Work



BRADFORD DRILLING —AND— TAPPING HEADS...

- - - will solve your problem. They can be assembled into a high production machine consisting of one or more heads mounted at any angle for drilling, reaming, hollow milling, countersinking or tapping. Industrial plants throughout the country have increased their production on an amazing range of special production work by the use of these tools.

For instance, with the above machine a manufacturer of automotive parts reams and spotfaces four holes in a universal joint housing simultaneously in six seconds.

Tell us your requirements. Our engineers will design a special machine guaranteed to increase your production.

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vertical. The welder should work upward. After he has progressed up a short distance with the weld, the piston head is revolved sufficiently to keep the point of contact at working position. If the welder desires to make a heavy deposit, he will find that he can do this easier by starting a litle lower than the above-described point, while if he desires a thin deposit, this can be better accomplished by starting a little higher.

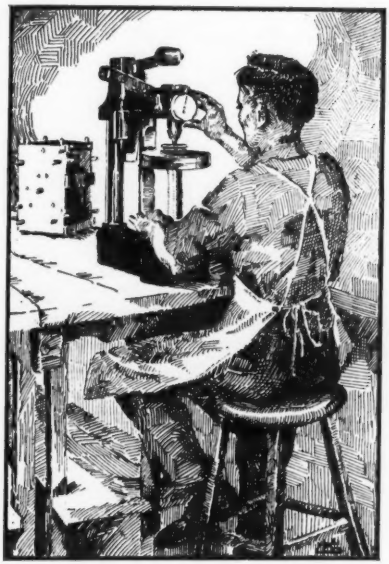
Since only the very surface of the cast iron need be brought to the melting point of the bronze in order to weld the bronze to the head, and since the bronze will not weld to cast iron when the surface of the iron is molten, care must be exercised not only to see that the cast iron is not heated to the melting point, but also that it is not heated much beyond the temperature at which it will receive the bronze. When the welder is heating the cast iron with his torch, preparatory to starting the weld, he should flux the surface well with a good grade of brazing flux. After this he should drag the end of his welding rod repeatedly over the portion of the surface that is being heated, and when the bronze begins to melt off and spread over the surface of the cast iron, the heating has progressed sufficiently to start depositing the bronze. So long as the bronze is melting and tending to spread over the surface ahead of the puddle, the heat is right, but should it start to roll back, the welder will know that the cast iron is becoming overheated.

It is not good practice to play the blast of the torch directly against the surface of the cast iron, but it should be directed upward and almost tangential to the circumference of the head. The bronze rod should be held radially to the circumference of the head, and should be rubbed on the cast iron at the advanced edge of the molten puddle.

After the welding operation is completed, the bricks that were removed should be put back in place and the furnace should again be covered, as shown in Fig. 3. No additional fire need be placed in the furnace, but the head should be enclosed until it has become cool enough to touch with the hand. Although at times, for special reasons, the piston heads are removed from the furnace and buried in dry sand to cool, it is best not to do this unless it is absolutely necessary.

Have Oiling Done By Oilers

Many shops still adhere to the system of depending upon the operators or mechanics to see that the equipment is oiled. The writer still remembers that one of the first rules laid down to him as a part of his training was that he should oil his machine before starting work on it in the morning, and should thereafter oil any other machine upon which he was required to work during the day. Placing the responsibility for oiling upon the operators is bad practice. If the workman is anxious to finish the job, he may neglect to oil the machine, or, if his work requires changing from one machine to another, he may assume that the man who used the machine before him oiled it. As neglect to oil a single bearing may cause a considerable amount of damage, all oiling should be done by an oiler, under the supervision of the millwright or machine repair foreman.



for testing the hardness of

Tools

Whether you make tools to use or tools to sell, you need a

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The other fellow says:

"As we are in the manufacture of a large variety of special and standard cutting tools such as gear hobs, Fellows gear shaper cutters, special and standard reamers, slitting saws, milling cutters, special counterbores, inserted blade reamers and milling cutters, and all special tools used in metal cutting which are made of high grade High Speed and carbon tool steel, we are using the Rockwell machine for testing hardness. We have found it very applicable to the different sizes and shapes, and where a close range of hardness and uniformity is required, we consider it the better method of checking, as it practically eliminates the human element which is a great factor in other methods we have used. It would be difficult to run our plant without it, as our hardness is held to a limit of two points, which we have been unable to maintain with any other method.

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How To Inaugurate a Suggestion System

By Russell Byron Williams

This is the second of three articles by Mr. Williams on this subject. The third article will appear in the November issue of MODERN MACHINE SHOP.

LAST month, in this place, I set forth the purpose of an industrial suggestion system and what such a system, properly installed and carried forward, might be expected to do. I wish, this month, to advance a few thoughts concerning the best methods of inaugurating such a suggestion system.

Although many different methods have been employed, analysis shows that, essentially, there are but two plans of operating suggestion systems now in general use. One plan limits the operation of the system to periodic contests, during which suggestions on particular subjects are solicited and the suggestion idea is aggressively pushed. The other plan makes the system operative throughout the year, with a schedule of awards to be paid at regular, stated intervals.

Experience has shown the latter plan to be much the better, except, perhaps, where the firm is relatively small and the number of employees few. The firm with a fairly large number of employees—say 50 or more—that tries to operate a suggestion system under the contest plan will find that, among the disadvantages which accompany any spasmodic effort, the worst is the liability of receiving a large number of inferior or worthless suggestions. These suggestions require time for attention and disposal—both of which cost money—and frequently result in dissatisfaction among the workmen. Then, too, the contest plan makes the payment of awards impossible until every case has been cleared—a delay that is often resented and misunderstood.

Suggestion systems are similar to any other phase of industrial relations or plan for the betterment of methods or product, in that they must have careful planning, constant supervision, and continuity of effort if they are to give maximum benefit.

Before launching a suggestion system, it is imperative that there be a clear conception of what is to be accomplished by that system. Will it be restricted to certain subjects such as invention, safety, and methods, or will it be made to apply to every phase of manufacturing or institutional activity? Because everything must be circumscribed and kept within due bounds, just what will be the limitations to the proposed system, regardless of its breadth of application? In short—define the purpose of the plan.

Who of those engaged will be eligible to make suggestions? Ordinarily,

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executives, employees on development or experimental work, and those appointed to membership on the suggestion committee are not eligible to awards unless their suggestions pertain to matters outside their own departments. If, however, in your individual case exceptions are to be

made to this common practice, such exceptions must be clearly defined and understood.

Naturally, the prime essential to the success of any suggestion system is the sincere conviction and full cooperation of every executive, department head and foreman. It must be obvious that, to succeed, the system must have the voluntary backing of the entire management, coupled with willingness on the part of each and every executive to work for its success and continued operation. The most carefully planned suggestion system will inevitably fail if only half-hearted support is given it by the management. The systems that are giving the best results are those which have been built up slowly and on a solid foundation.

Not a few department heads and foremen will feel that suggestions coming from the men under them are, in themselves, reflections on their foremanship or administration. Where such erroneous convictions are allowed to remain, even in a single case, the proper, profitable functioning of the system will be most effectually blocked. Not always does antagonism or detrimental undercurrent become visible or noticeable until after the system has been put into operation. Methods for overcoming such a difficulty are, however, apart from methods of inauguration.

Once the basic purpose for your system has been settled, the management completely sold on the whole proposition, and the eligibility of employees determined, the Suggestion Committee can be appointed.

Just who is to be appointed to make up this committee is more or less optional with each individual company. Such a committee should, however, consist of at least five but not more than eight or nine men. Five is set as the minimum, because in most cases every phase of plant operation can be represented and that number will bring to the discussions expert knowledge of every plant condition, while eight is set as the maximum because larger bodies of men may prove unwieldy. Even though it might be necessary for one or two of the committee members to be away at the time of the committee meetings, enough will be left out of the original five to properly dispose of suggestions and awards.

As might be assumed, the suggestion committee should be headed, wherever possible, by the president or

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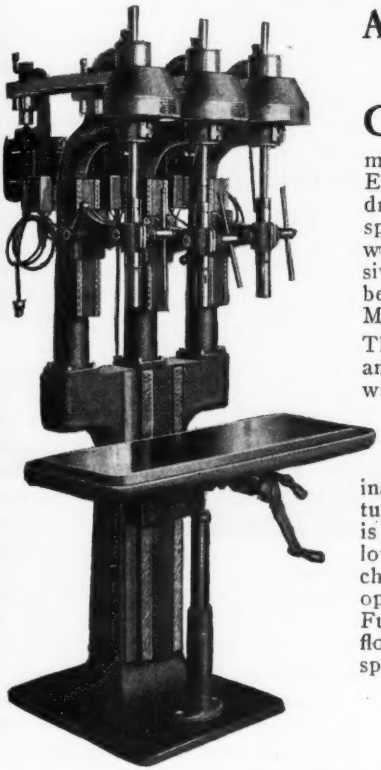

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CONSTRUCTED to give the highest degree of accuracy and speed—to meet the largest production demands. Each spindle has individual motor drive, which can be run at any desired speed, or stopped without interfering with other spindles. This is an exclusive CANEDY-OTTO feature, and can be found only on CANEDY-OTTO Motor Driven Drills.

The spindles have ball thrust bearings, and are amply supported by sleeves with extra long bearings. The cone pulleys rotate on Timken bearings and ball bearings.

Vertical mounting of motors eliminates idlers, pulleys, and twists and turns in belts. Large oil groove table is provided which can be raised or lowered and locked in position. Machines completely equipped ready for operation by attaching to lamp socket. Furnished in either 2, 3, 4, or 6 spindles, floor or bench type, in the following speeds:

400— 850— 1750 R. P. M.
1000—2200— 5000 R. P. M.
525—1400— 3000 R. P. M.
3400—5600—10000 R. P. M.

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controlling executive of the company. Not only will there arise suggestions that will demand his attention and consideration, but the psychological effect on the men of having the president on the committee will be most favorable. Other members should include the general manager, chief engineer or superintendent, and those familiar with company policy in management, production and distribution.

Here and there instances have been found where companies have abandoned the use of suggestion committees on the grounds that they were too slow and cumbersome, substituting therefore a single man, such as the general manager or production manager, who alone functioned as the committee. In general practice, however, the committee of five or six men will be found the most beneficial to all concerned.

While large financial rewards may not, in themselves, be the only incentive that will stimulate suggestions, it is absolutely essential to the lasting success of any suggestion system that the employees feel themselves fairly treated and that the benefit received by the contributor of the suggestion be proportionate to that gained by the company. For a man to make a suggestion, have it accepted and be rewarded with a check for a dollar or two might conceivably be all right for very minor suggestions. But let an award of $2 or $5 be made for a suggestion that obviously benefits the company an appreciable amount, and cynicism, undercover resentment, and the speedy death of the entire system will result. According to an article appearing in an industrial magazine (now discontinued):

TODAY
ARE WE BOUND WITH RED TAPE?
"Red Tape" is the term applied to hampering methods and needlessly involved systems. In the old days we used to say our government was all bound up in "red tape" because it was over-systematized.
Have we too much system? Can you think of anything we do, any form we use, that might just as well be eliminated?
If we are doing anything needlessly—if our forms could be simplified—if we have any unnecessary "red tape"—let's cut it out.
Tell us your ideas on this subject and help us cut out all possible "red tape".
Cutting out RED TAPE will be mutually profitable

"One of the reasons why so many suggestion plans have failed is because those who make suggestions or offer ideas which have been accepted and put into practice have felt that they have been inadequately rewarded.

"Some concerns, for example, give a dollar for each accepted suggestion. The employee naturally feels that he should be recompensed somewhat in proportion to the actual value of his suggestion. If it saves the company a great deal of money he feels that this should be taken into account in determining the award.

"Every progressive manager should be willing to invest money in ideas which will save money. If he can get an idea for $500 that will save his company $5,000 it is as good an investment as purchasing a machine for $500 which will cut the cost of production $5,000. The difficulty has been that many firms seem to fail utterly in actually measuring the results of the ideas submitted and applied."

By far the most universal practice

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The solid streams of sparks shooting from the grinding wheel prove that the high-speed "Safe-T-Bond" wheel (9,000 s. f./min.) is doing a real cutting job.

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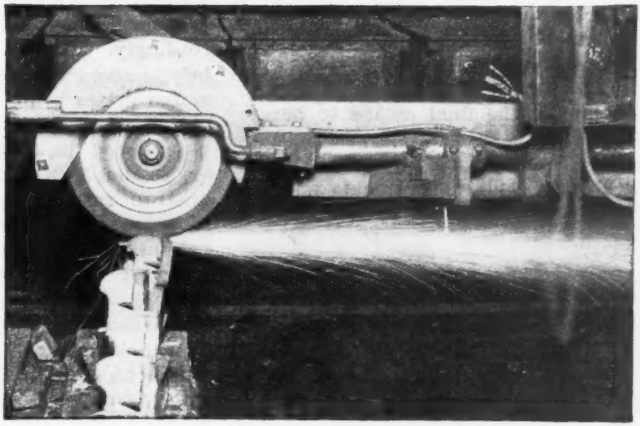

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For 37 years the Safety Grinding Wheel and Machine Co. has been building abrasive wheels and machinery. It has won dominant leadership in the industry by pioneering in the development of grinding wheels and machinery which cut operating costs and increase manufacturing profit.

The SAFETY "Rite-Speed" Grinder is years ahead of any other floor grinder on the market. The exclusive changeable speed device automatically *enforces* the grinding wheel speed to be increased as the wheels wear down . . . yet is driven by a *constant* speed motor. This feature alone will pay for the "Rite-Speed" in a short time by saving abrasive wheels and speeding up work.

A Wheel for Every Purpose

SAFETY Grinding Wheels can be furnished for slow, moderate or high-speed grinding . . . of gray and unannealed malleable iron, annealed malleable iron, steel, copper and other metals. We can furnish *any* type wheel for *any* job.

The "Safe-T-Bond" Wheel (bakelite bonded) has done much to advance the present trend toward high-speed grinding.

Profit By Our Experience

Let us help you tackle your grinding problems. We have the facilities, knowledge and experience. Let us show you . . . by records of actual installations . . . how SAFETY Grinding Wheels and Machines actually pay for themselves thru the savings they effect. Get in touch with us today. Write for complete information.

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among plants now successfully using suggestion systems is the fixing of a minimum award (usually $5) to be paid for each accepted suggestion, the amount of the final award to be determined by an analysis of cost records. Just as a cost system will indicate the weak departments and the

Are we in danger of fire ?
Bad fires often result in lay-offs, which are costly both to workers and management . . . . Are we flirting with fire?
* Money loss from a fire is bad enough, but loss of life is far worse. All danger of fire should be eliminated so far as humanly possible to do so. The management would consider it a favor to know if you are aware of any circumstances or conditions that seem to invite fire.
Please describe any danger points

lines along which suggestions are needed, so will it aid in equitably determining the value of an idea or suggestion to the company. Fully 70 per cent of the companies now operating suggestion systems estimate the savings possible through suggestions and fix the award to the suggestor in accordance therewith. Such procedure usually calls for the immediate payment of the minimum $5 upon acceptance, then a monthly distribution of awards after the value of the suggestion has been estimated by the cost system.

The most satisfactory method for rewarding suggestors, therefore, is to set up a minimum award ($3 to $5), estimate the actual cost value of the suggestions by cost records or expert judgment, then scale the awards accordingly. More and more is this plan being adopted and the system of stated prizes being abandoned.

Not all suggestions, of course, can be reduced to monetary values. A suggestion for the improvement of industrial relations, for instance, may be ever so valuable to the company, yet utterly without the bounds of financial calculation. Arbitrary awards must be set up, therefore, and these can frequently take the form of medals, certificates, banners for departments, a three-day vacation on full pay, a promotion, or the assignment of additional responsibility with increased compensation.

As examples of how awards are being arrived at by companies known to have been successful with suggestion systems over a period of years, we cite the following:

The Eastman Kodak Company rewards suggestions strictly according to their worth. The amount of the reward is determined, wherever possible, by the amount of saving effected or its value in increasing sales.

Yawman and Erbe Company pays 10 per cent of the first year's saving effected through the suggestion, unless, of course, the idea is of a very specific nature, in which event a special award is made rather than to have a patent taken out with continuous royalty payments as the result. Minor suggestions bring awards ranging from $1 to $5.

Remy Electric Corporation, subsidiary of General Motors Corporation, bases its awards for suggestions on time studies made over a given period, the length of the period depending upon the nature of the idea. Their minimum reward is $5.

Toy Tinkers, Inc., limit their sug-

(*Continued on page* 36)

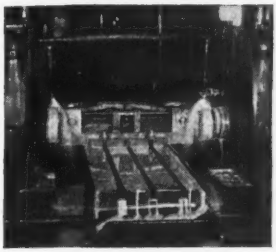
Manufacturers Airplane Parts Production SUNOCO

Briefly stated, these advantages are:—

1. *Increased cutting speeds.*
2. *More metal removed per tool grind.*
3. *Lighter proportions needed.*
4. *Renewals of cooling system necessary far less often.*
5. *Acts as a splendid rust preventive.*
6. *Unusual cooling properties.*
7. *Protects operators from skin infection.*

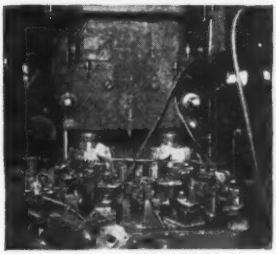
SUNOCO contains no animal or vegetable fats, rosin oil, ammonium hydrate, coal tar products or alcohol. It mixes easily with water and stays mixed. No odors—and keeps the whole system cleaner.

If you wish the cooperation of Sun Engineers in reducing your overhead and increasing your production, communicate with the nearest office listed below.



COURTESY OF AUTOCAR COMPANY
ARDMORE, PA.

OPERATION: MILL BOTH ENDS CONTROL CROSS MEMBER.
MACHINE: CINCINNATI DUPLEX MILLER.
MATERIAL: MALLEABLE IRON.
CUTTERS: 7 IN. FACE MILL (1 RIGHT, 1 LEFT)
SPEED: 100 R. P. M.
FEED: 7½ IN.
LUBRICANT: 1 PART S.E.C.O. TO 20 PARTS WATER.



COURTSEY OF WARNER CORPORATION
MUNCIE, IND.

OPERATION: SURFACE MILLING STEERING GEAR CASES.
MACHINE: NEWTON 50 IN. VERTICAL MILLER
MATERIAL: MALLEABLE IRON.
CUTTER: 12 IN. DIAMETER
WIDTH OF CUT: 11 INCHES.
DEPTH OF CUT: ½ INCH.
SPINDLE SPEED: 65 R. P. M.—180 FT. PER MINUTE, CUTTER SPEED.
FEED: 24 IN. PER MINUTE.
PRODUCTION: 144 PIECES PER HOUR
CUTTING LUBRICANT: 1 PART SUNOCO—20 PARTS WATER.

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CUTTING OIL

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MONTREAL	PITTSBURGH	SYRACUSE		

Suggestion Systems

(*Continued from page 32*)

gestion system and make it applicable only to invention of new toys or modifications of present ones. The inventor of any adopted toy is paid $250 per year for a period of five years,

providing the Toy Tinkers continue the manufacture of that toy for that length of time. Discontinuance of manufacture automatically reverts all rights of the toy to the inventor.

Consolidated Gas, Electric Light and Power Company offered during 1926 the following schedule of awards:

For suggestions effecting a reduction in net operating costs, after due allowance for capital or other costs, of—

Value to Company	Awards
$5,000 or over, per year	$250
1,200 to $5,000 per year	100
500 to 1,200 per year	50
100 to 500 per year	25

Mead Pulp and Paper Company have a slightly more involved schedule of awards, the amount of the maximum being determined by the value of the suggestion to the company, in all classes except those applying to accident hazards or "conveniences." Their schedule, as printed at the top of their suggestion blank is:

Price Awards	Minimum	Maximum
1. Improvement in product	$5	None
2. Reduction in costs	5	None
3. Improvements in methods or machinery	5	None
4. Reduction of accident or fire hazards	2	$10
5. Conveniences	1	5

Under this schedule a suggestion calling for the repair of treads on a stairway would fall into the class of either No. 4 or No. 5 and be rewarded accordingly; whereas a suggestion affecting some established practice or manufacturing method would naturally be subjected to analysis by cost records for the determination of the proper reward. "No maximum" means "no limit" to the size of the award.

Bird and Son, Inc., have had a suggestion system in continuous operation since 1912, during which time, naturally, there have been several changes and improvements made. Their system of awards, however, has remained substantially without change. A five-year record of performance for their system is given below, in which should be noted that the number of suggestions made, together with the percentage accepted and the worthiness of the ideas has increased more rapidly than the payroll. Nothing could be more indicative of good health in a suggestion system.

Year	No. of Suggestions Considered	Accepted	Amount Paid	Avg. No. of Employes
1922	420	87	$ 780	1,478
1923	385	96	785	1,596
1924	538	134	1,270	1,680
1925	552	163	1,545	1,728
1926	897	271	1,970	1,750

(*Continued on page 62*)

FOSDICK

3-foot, 4-foot, 5-foot 6-foot, 7-foot

"ECONOMAX" RADIAL DRILL

for heavy duty drilling

Universal control at head.

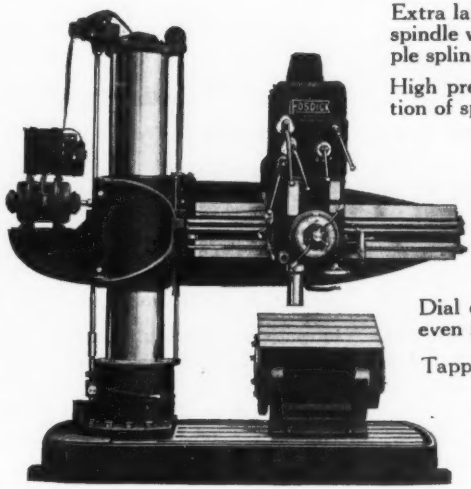
36 spindle speeds.

18 feeds and 3 pipe-tap leads.

Hardened alloy steel gears.

Automatic lubrication.

Tapered roller bearings.



Extra large alloy steel spindle with six multiple splines.

High pressure lubrication of spindle.

Power rapid traverse of head on arm with friction drive.

Quick return of spindle.

Dial divided into even inches.

Tapping and driving mechanism with indestructible multiple disc frictions.

The combined results of years of experience in designing and building drilling machines are incorporated in the design of this machine. It is a beautiful example of modern engineering skill.

Ask For Specifications

THE FOSDICK MACHINE TOOL CO.

CINCINNATI, OHIO, U. S. A.

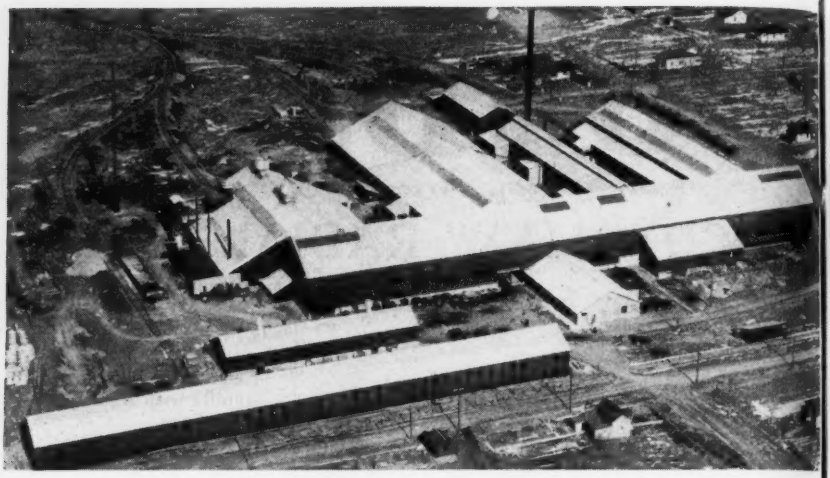


Fig. 1—Plant of the General Iron Works, Denver, Colo.

Competing Firms Operate Co-operative Machine Shop

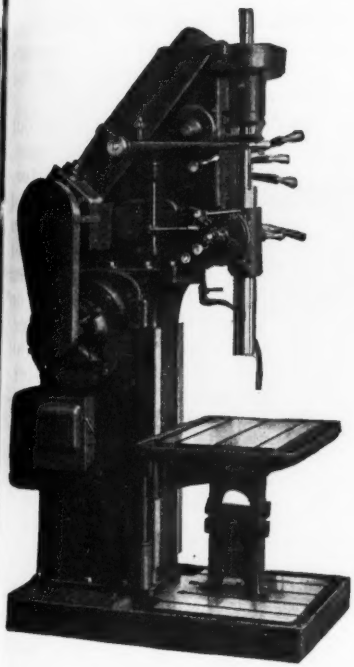
By IRA R. ALEXANDER

A COMBINATION of competing firms to reduce costs, permit large scale production and to control other phases of business is common in business today. When, however, competing firms combine their manufacturing facilities but remain competing firms in all other respects, we have a business institution which economists have not as yet named. The General Iron Works of Denver, Colo., is a combination of this sort.

Denver, the seat of the mining industry, headquarters for the production of beet sugar, immensely concerned with irrigation machinery and an important industrial center in other respects, naturally boasts of many machine shops and iron-working plants. For years the different concerns have bid for the iron and steel trade of the region, maintaining separate plants, individual office and sales forces, and putting out similar products under various trade names.

The costs involved in the operation of individual plants made it possible for outside firms to compete—sometimes successfully—for the local jobs, with the result that, when the matter of consolidating manufacturing facilities was first broached, some eight years ago, several of the larger firms were in a receptive mood for suggestions. Since that time the immense plant of the General Iron Works has been developed. This co-operative competitive plan was not the sudden inspiration of one man, but was rather the result of years of careful thought on the part of each of the companies concerned.

The General Iron Works plant manufactures for the Stearns-Roger



Rigid
Speedy
Powerful
Quick Control
Durable
Efficient

Capacity, 2″ In Steel

No. 242 Self-Oiling All-Geared Drilling Machine

For drilling, tapping, boring, reaming and kindred operations including cylinder-honing. Self-Oiling All-Geared Machines are the last word in equipment for the modern machine shop.

No. 242 drives a 2″ drill to capacity in steel. It leads the Self-Oiling All-Geared Line and has all of the special features in design and construction which make these machines so profitable. These are fully described in Catalog U — send for it.

BARNES DRILL CO.

801-851 CHESTNUT STREET ROCKFORD, ILLINOIS

Manufacturing Company, Dorr Company, Vulcan Iron Works Company, Mine & Smelter Company and the Colorado Iron Works Company. The plant is owned by the Stearns-Roger Company, Vulcan Company and the Colorado Iron Works Company, each of the owner-firms occupying a seat on the board of directors.

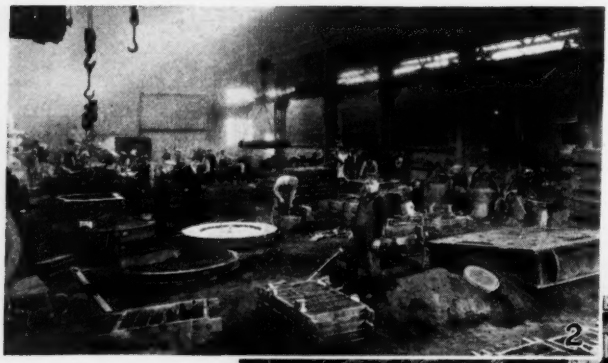


Fig. 2—The foundry at work. Fig. 3—Looking down the "west bay" in the machine shop, with part of boring mill department in the foreground.

At the time of consolidation, each company dismantled its own shop. Appraisers evaluated the machinery of each, and common stock in the General Iron Works was issued to the member firms on the basis of the value of their equipment, which thus became the property of the new firm. A new plant was built as nearly perfect in arrangement and design of building as was humanly possible to conceive, and into this was moved such equipment from the dismantled shops as was needed and worthy of a place. New equipment was purchased until the plant was complete in every detail, and the surplus machinery was disposed of for what it would bring.

The General Iron Works turns out work for its stockholders at cost, which cost is determined by the board of directors. An overhead rate is set each month, based on the work on hand. In this overhead are included all direct costs, interests, funded indebtedness and depreciation ample to cover replacement of tools, buildings and equipment, direct labor and material. Labor, material and overhead are invoiced at cost. Depreciation and similar expenses are assessed in proportion to labor or material used, or sometimes based on both. At the end of each month detailed invoices against each firm are lumped together and the total amount due must be paid by the fifteenth of the month following. No fixed maximum or minimum amount of work is

Sheldon 90° Angle Plates

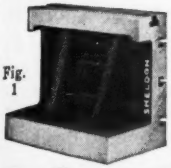


Fig. 1

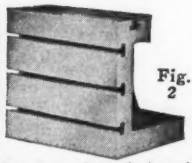


Fig. 2

These Plates are made of semi-steel, heavily ribbed, insuring close-grained, rigid castings.

With Second Face and T Slots

No.	Size Face	Size Top	Size Base	T Slots	Wt., Lbs.	Price, Each
1T	3¾ x 5	1½ x 5	2½ x 5	4–¼"	5	$10.00
2T	6 x 7	2½ x 7	4½ x 7	4–½"	20	15.00
3T	8 x 9	3 x 9	6 x 9	4–½"	38	20.00
4T	10 x12	3½ x12	7¾ x12	4–⅝"	75	30.00
5T	14 x16	4 x16	9 x16	4–⅝"	170	45.00

SHELDON 90o PLAIN ANGLE PLATES

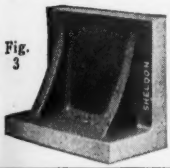


Fig. 3

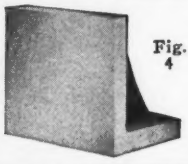


Fig. 4

No.	Size Face	Thickness Face	Size Base	Wt., Lbs.	Price, Each
1P	3¾ x 5	½	2½ x 5	4	$ 8.00
2P	6 x 7	¾	4½ x 7	15	10.00
3P	8 x 9	1	6 x 9	30	14.00
4P	10 x12	1¼	7¾ x12	60	20.00
5P	14 x16	1½	9 x16	145	30.00

Sheldon "Set-Up" Jacks

Fig. 1 Planer Jack

Fig. 2 Vertical Jack

Fig. 3 Bracing Jack

PLANER JACKS (Fig. 1)

No.	Height, Contracted	Height, Extended	Diam., Screw	Weight, Lbs.	Price, Each
1	2¾	3¾	⅞	1½	$1.25
2	3¾	5¼	1⅛	3	2.10
3	5¼	7½	1¼	6	3.00
4	7½	12	1½	12	6.00

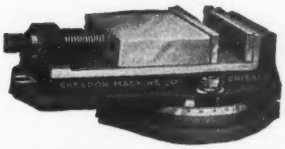
VERTICAL JACKS (Fig. 2)

1	2¾	4	⅝	1½	$ .75
2	4	7½	⅝	2	1.10
3	6¾	12	¾	5½	1.70
4	8¾	15	1	7	2.50

BRACING JACKS (Fig. 3)

1	3¾	6	⅝	1	$ .65
2	4¾	8	⅝	2	1.00
3	6¾	12	¾	3	1.50
4	8¾	16	¾	4	2.10

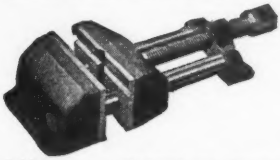
Sheldon Milling Machine Vises



Furnished Both Plain and With Swivel Base.
SPECIFICATIONS AND PRICES:

No.	Width of Jaws	Depth of Jaws	Jaws Open	PLAIN VISE Wt., lbs.	PLAIN VISE Price	SWIVEL VISE Wt., lbs.	SWIVEL VISE Price
3	3½"	1⅜"	2½"	15	$16.00	25	$20.00
4	4½"	1⅝"	3½"	30	$20.00	45	$24.00
6	6½"	2 "	4½"	70	$30.00	90	$40.00
8	8½"	2½"	7 "	160	$45.00	225	$60.00

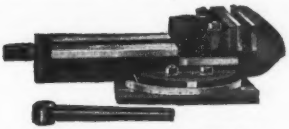
Sheldon Drill Press Vises



Guide Bars are Hardened and Ground.
SPECIFICATIONS AND PRICES:

No.	Width of Jaws	Depth of Jaws over Guide Bars	Full Depth of Jaws	Jaws Open	Wt., lbs.	Price
D 4	4½"	1⅝"	3"	4"	15	$12.00
D 6	6½"	1⅞"	3½"	6"	35	$18.00
D 9	9 "	2½"	4½"	9"	70	$24.00

Sheldon Shaper Vises



SPECIFICATIONS AND PRICES:

No.	Size of Jaws	Vise Opens	Bolt Hole Spacing*	Wt., lbs.	Price
1	12" x 2½"	12½"	7½"	175	$120.00
2	14" x 2¾"	13½"	8½"	240	$135.00

*Distance between holes can be changed without additional charge.

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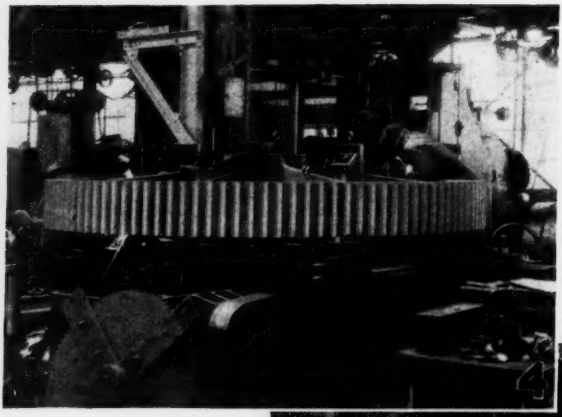


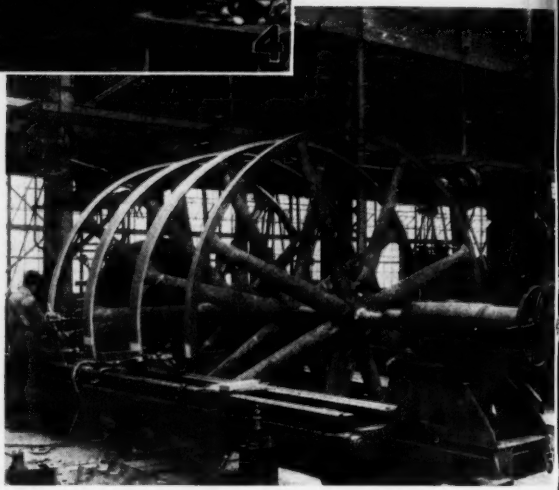


Fig. 4—One of the large gear cutters in action. Fig. 5 — This pit lathe will swing 20 feet, and is 41 feet long.

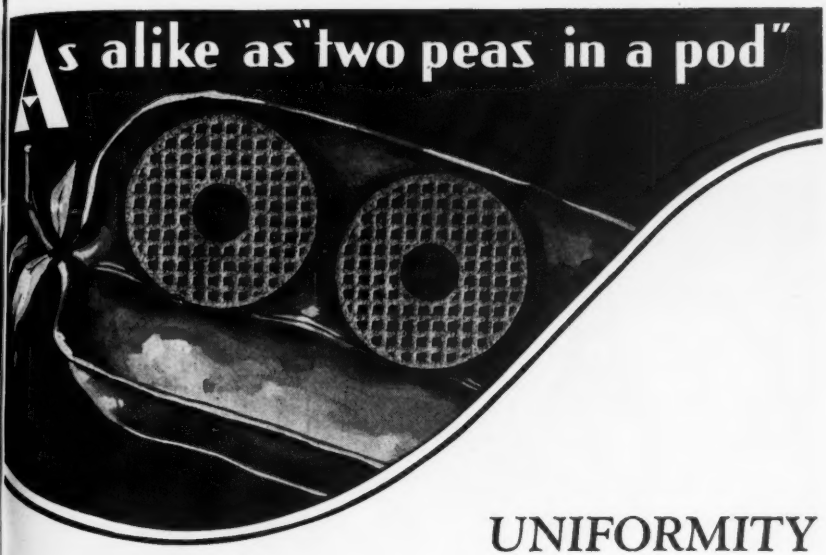
set for each company, as it is obvious that the amount of work in process for one firm will vary.

The best of the men from the old shops were given places in the new plant, and new blood was added. An item of no small importance in the success of the venture is the enthusiasm of the younger men of the organization, although controlled and held in check by the older members of the "Management Board"—some of whom have served their companies for thirty years and longer.

The excellent arrangement of the different buildings that go to make up the plant of the General Iron Works is shown in the airplane view of the plant, Fig. 1. The ten large buildings, all but two of which abut the main storage building, cover almost 14 acres of ground. The pattern storage building and the pattern shop are the only two buildings detached, which is necessary because of the inflammable materials they contain.

The machine shop is 400 feet long by 200 feet wide; the foundry is 250 by 150 feet; the warehouse is 500 by 100 feet, and the other buildings are in proportion. The larger buildings are 60 feet high. Each building is built on a base wall four feet high above which are windows of from 16 to 20 feet in height. Sky-lights run the full length of the buildings.

Figure 2 shows an interior view of the foundry, and gives an idea of the system and order prevailing there. Both the overhead cranes serving this department, a fifteen-ton and a twenty-five-ton, are shown stacking flasks. In the right background are the core ovens and in the extreme left is the sandslinger. This wonderful labor



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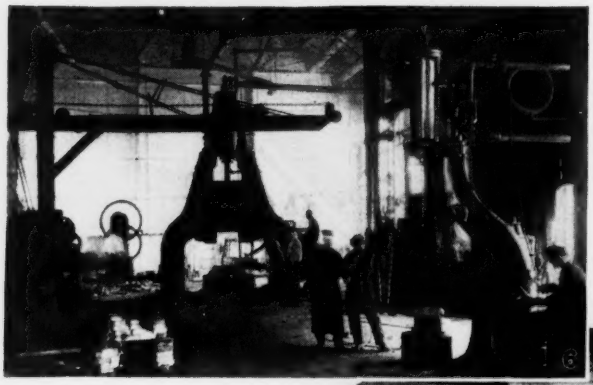


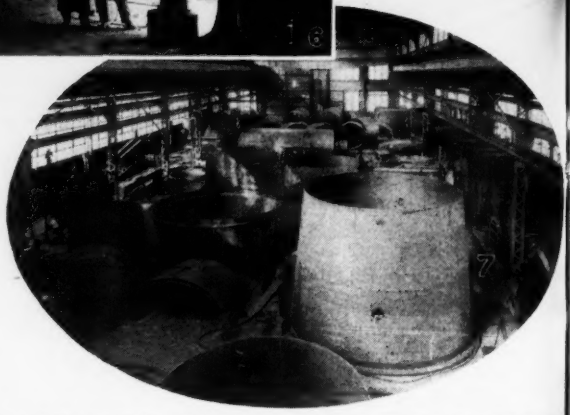


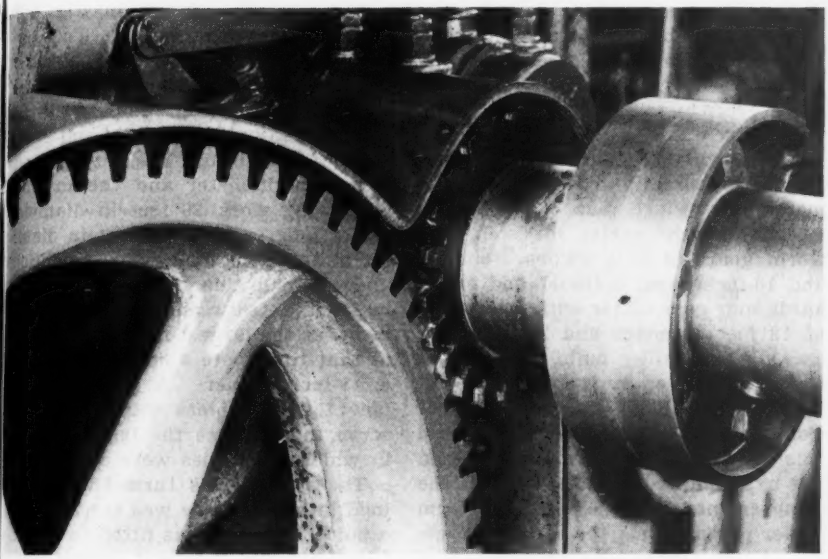
Fig. 6—Interior of forge shop. Fig. 7—The plate shop equipment will handle ⅝-inch plates. Bar stock 1¼ inches in diameter is welded in this department.

The average daily output of the foundry is approximately 50,000 pounds, although it has run as high as 80,000. The castings are of iron and semi-steel. Adjoining the foundry is the chipping room, in which the usual type of tools are in use. This room is really the end of the long warehouse and is served by the same two overhead cranes.

Castings of all kinds, tubing, steel billets, and boiler plate, as well as finished machines, are neatly stacked away in the warehouse. About halfway down one side of this huge room, just behind the office, is the small parts store. Opposite the small parts store, built on a balcony, is a special warehouse in which is kept the more valuable small parts. This storage contains 50,000 separate articles, so arranged that one girl is able to take charge.

The machine shop is divided into five separate departments, segregating the lathes, boring mills, milling machines and planers, gear cutters and assembly floor. There are nine vertical boring mills ranging in size from a monster 12-foot machine to a 24-inch Bullard, which, together with the five horizontal boring mills, can handle efficiently any job in boring that may come along. Gears, hoist drums, ball mills, pulp presses and gear housings are representative of the work that can be machined with this equipment.

Figure 3 gives an excellent view of the west bay of the machine shop with part of the boring mill department in the foreground. About one-half way down this bay and to the



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right is the gear cutting department. This department includes a Gould and Eberhardt hobbing machine which will cut spur, helical, herring bone and worm gears up to 50 inches in diameter and 12-inch face; a Pfauter hobbing machine will cut spur, herring bone and worm gears up to 77½ inches diameter and 20-inch face; a Gould and Eberhardt gear cutter for spur and worm gears of 77½ inches diameter and 16-inch face; a Gould and Eberhardt spur gear cutter with a capacity of 12 feet diameter and 20-inch face and a worm miller built from an old Cincinnati miller by the General Iron Works and Fred Ross Eberhardt Company. It was necessary to build this machine because a machine could not be found at that time to meet the requirements of this shop. This worm miller probably has the largest capacity of any machine of its type. The largest worm cut on it so far was 10⅜ inches diameter, 2½ inches circular pitch and 14 inches in length.

Figure 4 shows the Gould and Eberhardt spur gear cutter in operation. This department cuts special worms and a general line of gears. Among the jobs that have passed through this department was one consisting of ten worms each of 40 point carbon steel, 1-inch circular pitch, 3¾ inch pitch diameter, and 3¼ inch long, and the time was 13 hours for cutting the 10 worms. A pinion of 35 point carbon steel, 2¼ inches circular pitch, 18 teeth, and 1½-inch face was cut in 6 hours.

Castings are handled in the machine shop by two large overhead, traveling cranes in the center span of the shop, and by three two-ton electric cranes that are operated from the floor in each of the side bays. Transportation of the lighter materials in the machine shop and throughout the whole plant is accomplished by a fleet of electric trucks.

The pit lathe shown in Fig. 5 is worthy of special notice. This machine was designed by D. J. Nevill of the Stearns-Roger Company and built by the company in 1891. All the parts, including the spindle and gears, were of cast iron. The face plate is 7 feet in diameter and the machine will swing work 20 feet in diameter, 7 feet long or work 14 feet in diameter and 41 feet long. The conditions under which this machine was built make it a truly remarkable achievement, as the largest machines at hand at that time were a 36-inch lathe and a 48-inch planer. A description of how the face plate was turned will serve to illustrate the ingenious way in which difficulties were overcome.

The spindle was turned in the 36-inch lathe, the nose was threaded and a suitable flange was fitted to it. The face plate was then cast, with a recess in the back to fit the flange. The flange with spindle attached was bolted to the face plate, the irregularities between the flange and rough cast face plate being filled by pouring the recess full of babbitt. The spindle was then mounted in its own bearings and the face plate turned and faced. This machine has never had a breakdown of any kind except a broken spindle, twenty-five years ago, which was caused by the great weight of an 18-ton casting, 36 inches wide, which snapped the spindle. The spindle was replaced with one of semi-steel and the machine is still giving excellent service.

Figure 6 shows the interior of the forge shop. Here a 55 hundred pound hammer can be seen forging a huge billet to shape, with a 15 hundred pound hammer at work on a smaller one. The steel is heated by oil furnaces and coal forges. An Ajax forging machine speeds up work on many jobs.

The plate shop, a general view of

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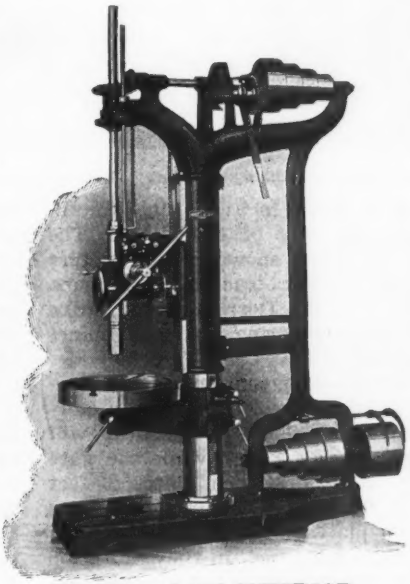

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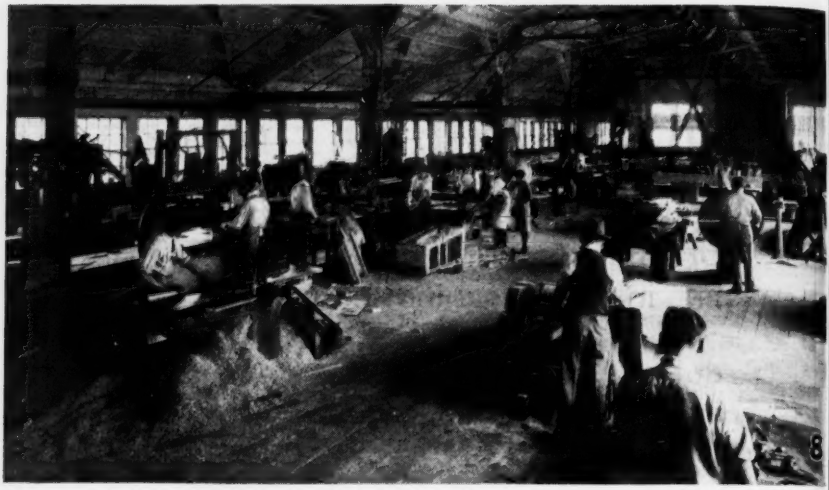

Fig. 8—Nothing necessary to the production of good patterns is lacking here.

which is shown in Fig. 7, lacks nothing in the way of equipment. The large cylinders shown in the picture are drums for traction thickeners, products of the Dorr Company, to be used for dewatering sludge in mines or sewage.

The plate shop contains several five-foot rolls and two twelve-foot motor-driven rolls. The rotary shear will handle ½-inch plates, while the gate shear will cut ⅝-inch plates, 6 feet wide. The bevel shear will handle ⅝-inch plates. There is also a Long & Allstratter punch in the plate shop which will deliver 350,000 pounds at the nose of the punch and is capable of twenty-five strokes per minute. A 1-ton bulldozer provides means for flanging, and a Federal Electric butt welder with a capacity of 1¼-inch bar stock is a part of the equipment.

The shops employ from 300 to 600 men the year round, three shifts being employed during the busier season and two shifts at other times. The men are paid an hourly rate plus a bonus, the bonus feature differing from most plans in that the bonus is based on the number of hours saved on the estimated time for doing the job, rather than on the earnings. Fifty per cent of the amount saved goes to the company, 45 per cent to the men on the job and 5 per cent to the foreman.

The merging of manufacturing facilities in the manner described here has developed many advantages that would have been otherwise impossible. The business of all the firms involved has increased, due to lower production costs and better facilities for production. Since only the best employees were retained, the standard of workmanship is higher than before and the men are assured of steadier employment. Competition is just as keen as ever before, but this very competition works to the benefit of all. The more work each firm can give the General Iron Works, the lower the production costs are for all. The customer benefits because he is able to make his purchases more cheaply and is assured of better deliveries.

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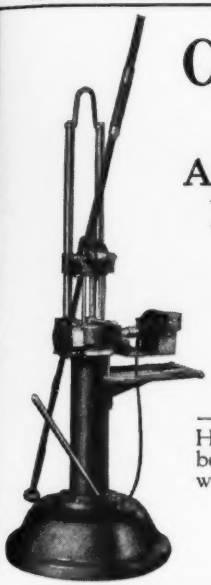

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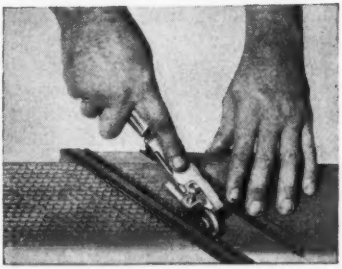

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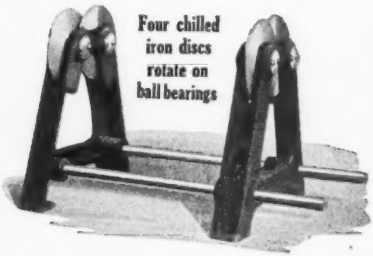

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Safety is Good Business

By FRED G. LANGE,
Special Representative, Division of Safety and Hygiene, State of Ohio

SEPTEMBER 29 to October 5 is "National Safety Week." During this week hundreds of the more progressive industrial units throughout the country will take stock of the work that has been done to promote safety in their individual organizations in the last year, campaigns will be undertaken to impress the value of safety upon the workers, and further steps will be taken to advance the cause of safety in industry.

Industrial America was well along in this age of invention and mechanical development before certain minds attuned to the needs of mankind recognized the importance of taking definite steps for the prevention of accidents.

In its inception, the safety idea was motivated by urgings of a purely humanitarian nature. It was looked upon as a social problem—a movement to ease the struggles of dependency and reduce the physical suffering and mental anguish incidental to accidents in the fields of industry. It is only recently that executives in industry have discovered that safety is not only good ethics and good morals but good business as well.

When the first efforts to conserve the lives and limbs of workers through regulatory measures that made the installation of mechanical safeguards mandatory were made, the attitude of many employers was distinctly antagonistic. They felt that their right to conduct their establishments according to their own ideas was being infringed upon by an effort to mix sentimentalism with business, to the detriment of production and at the expense of profits. There may still be isolated instances of employers holding tenaciously to this antiquated idea, but the conversion of a large majority of industrial executives to the value of safety methods and safe practices has been accomplished. And there's a reason.

Some of the largest industrial corporations in America soon discovered that the safety measures taken by the various states were productive of good results, but safeguarding employees against accident by mechanical devices was not sufficient. They learned that even a perfectly-guarded shop did not take into account the human elements of thoughtlessness and carelessness. And from this deduction came the idea of safety education in industry, the plan of inculcating a spirit of safety consciousness into the minds of the workers, and of keeping the ideal of safety constantly before them through the use of literature and posters and through the medium of shop organizations which gathered and tabulated accident statistics and analyzed all accidents with a view of preventing their repetition.

The education safety idea has promoted the development of safety commissions in many states. The plan of Workmen's Compensation was not new. Factory inspectors, empowered with authority to enforce the specific requirements for safety, were sowing the seeds of safety thought throughout industry The industrial commissioners, carrying on their work under the slogans "Safety is Better Than Compensation" and "Safety Pays Dividends," soon realized that if the

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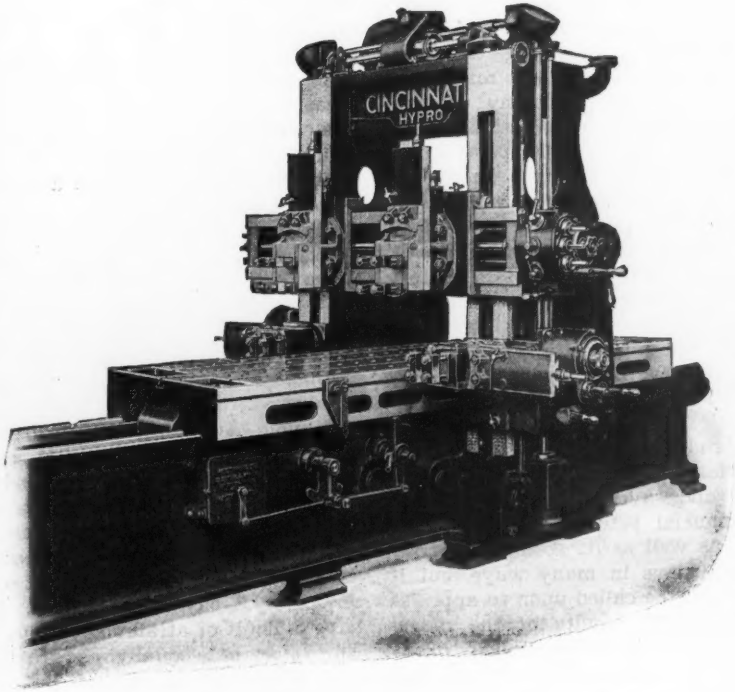

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large percentage of industrial accidents was preventable, safety was literally better than compensation. In at least one state the legislature created a Safety Division and a constitutional amendment set aside one per cent of the premiums paid into the state insurance fund to defray the expenses of an organized movement designed to reduce industrial accidents to a minimum.

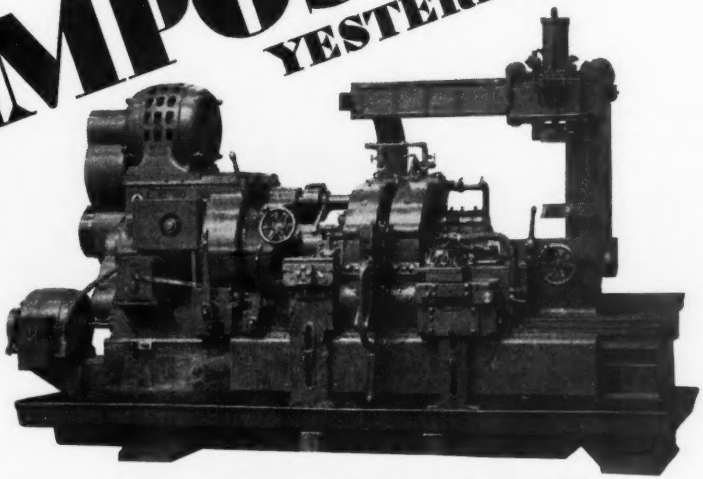
The fruits of the efforts made thus far are seen in the many splendid industrial safety organizations which have grown up in every part of the country. It is no longer an experiment, as the economic as well as the humanitarian results of educational safety effort have long since passed beyond the experimental stage. Safety has been definitely proven to be not only better than compensation for the worker, but that it also pays dividends to the employer. Carefully recorded statistics of industrial organizations throughout the country give practical demonstration of the fact that it not only conserves manpower and saves suffering, but that the financial returns prove its economic as well as its social value.

Safety pays in many ways, but if we were to be called upon to appraise the beneficent results of the movement, we would be compelled to say that the greatest asset that has come to industry through the application of the safety idea—greater even than increased production and the attendant ascendency on the profit side of the ledger—is the amity and good will that it has created between employer and worker. It has been a great leveler of prejudices; it has made for a better understanding; it has established a common brotherhood which will soften the asperity of conferences on the more important differences between management and men and accentuate that fair-mindedness and accord which are becoming more and more apparent in this wonderfully progressive age.

A good example of the work that is being done is found in the Division of Safety and Hygiene of the State of Ohio, where, under the direction of Superintendent Thos. P. Kearns, an organization has been built up which offers important safety services to Ohio employers. In addition to the creation of safety codes covering various classifications of industry and which are being steadily revised and added to, the division has a monthly bulletin and poster service which is free to all employers and furnishes safety material, advice and counsel upon request. Its staff of safety engineers, selected solely for their qualifications and their familiarity with certain classifications of industry, are available to every employer for safety surveys without cost or obligation, and hundreds of plants in Ohio which have taken advantage of this service can attest to its value in detecting accident hazards and recommendations for their elimination, and in initiating plant safety organizations.

"Safety is one of the highest ideals of society," says Mr. Kearns, "perhaps difficult of attainment in its fullest sense, but equally as gratifying and profitable as any of the other idealistic motives which prompt us to plan and strive for the betterment of mankind. It is a personal inspiration, all-pervading and soul-satisfying, destined to be one of the most potent influences in the changing fabric of modern life and in shaping the trend of modern industry. It is the Spirit of Service personified. It is the will of the Master exemplified. Let us all visualize it, grasp it and stick to it, making it one of the tenets of our faith in humanity."

IMPOSSIBLE YESTERDAY ...



PRACTICAL TO-DAY

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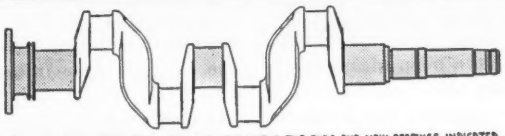


AUTOMATIC CRANKSHAFT LATHE SIMULTANEOUSLY TURNS THE ENDS AND MAIN BEARINGS INDICATED

Madison and Edwards Roads Cincinnati, Ohio

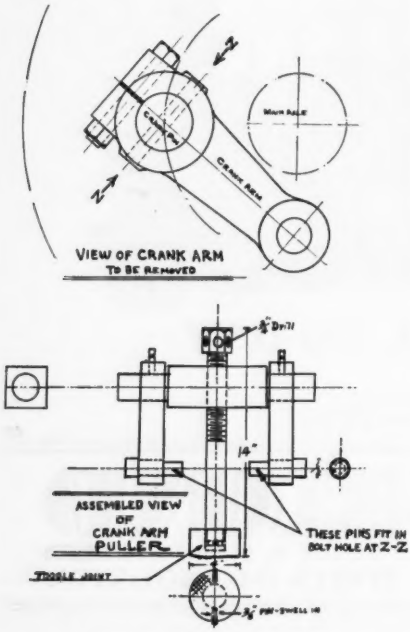
Ideas From Readers

This department is a clearing-house for ideas. If there is a "kink" or short-cut in use in your shop, send in a description of it. We will pay $5 for each one published.

Locomotive Crank Arm Puller

By H. H. PARKER, JR.

THE drawing shows the details of construction of a tool for removing crank arms from modern locomotives. There have been many times in the past when the tight fit of a crank arm has caused a mechanic to beat and bang the crank arm with a sledge hammer trying to get it off. With this device, the work can be done quickly and easily, and without the use of a sledge.



Locomotive Crank Arm Puller

The body of the tool consists of a square bar of steel, 16 inches long by 3¼ inches thick. The piece is tapped through the center for a 1½-in. 6-thd. screw, and four inches of each end is turned to 2¼ inches diameter. The screw is 14 inches long from the top of the head to the end of a piece that is fastened on the end of the screw with a pin, as shown, to form a toggle joint. On the turned portion at each end of the body is placed an arm, 2 inches thick, which carries a pin with a 1¼-inch body and a 1½-inch head. The inside end of the pin is turned to 1 inch diameter to fit into the bolt holes in the crank arm. These pins are pressed into place. When the pins on the arms of the tool are in place in the crank arm bolt holes, the arm can easily be pulled off by working the screw in.

Check Punch and Die Clearances With Paper

By PAUL A. BARD

THE paper test for checking the clearance between punch and die is a very simple one and an extremely convenient one. It not only affords a quick and easy way of limit-gaging the clearance between punch and die but at the same time shows the condition of all cutting edges. One great advantage of using paper instead of metal is that the paper may be easily used, and without a set-up on the press. Moreover, by checking

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the clearance of the die while the die set is in the press, it is possible to determine whether the die should go to the tool room to be stoned. The die set may go to the rack, while the paper with a few blanks or stampings go to the tool room for examination as convenient.

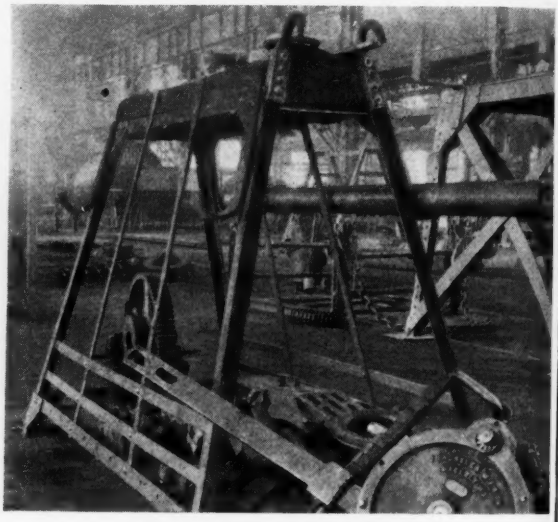
The paper used should be a tough sheet having a thickness slightly greater than the clearance between punch and die, being, in fact, about half of one-thousandth of an inch greater than the clearance. When the clearance between punch and die is exactly right, the paper will be compressed and cleanly folded all around. On the other hand, if the clearance has decreased, the paper will be broken. The paper will show a clean cut when sharp edges exist on both punch and die. If the paper shows a ragged edge, either the punch or die is dull or else there is insufficient clearance between them.

When the paper is not cleanly pressed, it is apparent that the explanation lies with the clearance—providing, of course, that both punch and die are sharp. A magnifying glass should be used to examine the condition of the cutting edges and to study the appearance of the impression upon the paper. A little experience and experimentation with paper as described above in conjunction with a magnifying glass will quickly develop a short-cut method for maintaining dies.

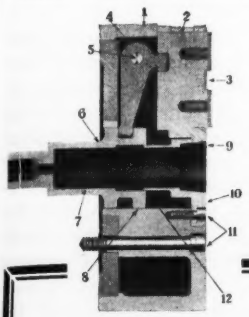
Keeping Cylinder Boring Tools Together

By Jos. C. Coyle

TO avoid cluttering up the floor of the machine shop, and in order to keep the machines and tools used in boring locomotive cylinders always ready for use, the rack shown here was devised at the shops of the Denver & Rio Grande Western Railroad. It is six feet high by four feet wide at the base, and is six feet long. The posts are of 4-inch angles, well braced by metal bars and plates which are riveted on at the corners. A steel-bottomed tray at the top and one at the bottom are used in which to store the boring machines and accessories, while the boring bars are placed in two large hooks at each side. Heavy hooks are riveted to each corner of the rack at the top, so that it is but a moment's work to hook on with the overhead crane, ready to move.



Rack for Cylinder Boring Tools

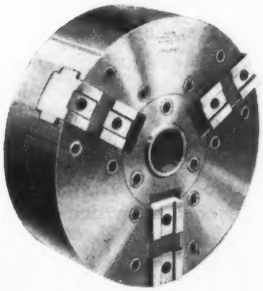


DETAILS OF

HANNIFIN

Model "B" Air Chuck

1 **BODY**—One-piece electric steel casting.
2 **SINGLE HEAVY DUTY SLOT.**
3 **MASTER JAWS**—Carbonized, hardened and ground.
4 **JAW OPERATING LEVERS**—One-piece extra heavy chrome nickel forging, heat treated hardened and ground.
5 **PIN**—Chrome nickel, heat treated, hardened and ground.
6 **DRAW SLEEVE** — One-piece chrome nickel, heat treated, hardened and ground.
7 **DRAW SLEEVE**—Bored to accommodate boring bar pilots.
8 **DRAW SLEEVE**—Ground slide fit in chuck body.
9 **PILOT BUSHING** — Mounted in taper bore of pilot plate assures rigidity and accuracy.
10 **HARDENED AND GROUND PILOT PLATE**—Mounted on the face of chuck reinforces chuck body.
11 **HOLLOW HEAD SCREWS**—Heat treated nickel steel.
12 **ACCURATELY GROUND FIT** of pilot plate and draw sleeve makes chuck dust-proof.



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AIR OPERATED

CHUCKS

Made to a design that guarantees precise machining, absolute accuracy, and interchangeability!

HANNIFIN Chucks have a minimum number of working parts. One-piece electric steel body gives unusual strength with lightest practical weight. A single set of grooves replaces the old style multiple grooves—another important improvement which assures long life and proper load distribution—resulting in the chuck retaining its accurate fit indefinitely.

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GREAT BRITAIN—Coats Machine Tool Co.
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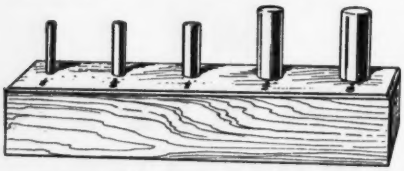
GERMANY—George Stenzel Co.
Frederick Strasse, Berlin, Germany.

FRANCE—Fenwick Freres Co., 8 Rue De Rocroy, Paris, France.

Dowel Pins Serve as Substitute Gages

By EDWARD LEDUC

ABOUT a year ago our shop received an order which made it necessary to produce in large quantities, requiring a large amount of inspection and testing. Consequently a large number of duplicate gages were required, the cost of which promised



Dowel pins mounted in a block to serve as routine gages.

to assume serious proportions. The problem was solved very inexpensively —about 5 per cent of the ordinary cost—and quite satisfactorily.

We had been users of Danly standardized dowel pins for many years, and were aware that these pins are of carbon steel, hardened, ground, and lapped. As they are ground to within .0001 inch of their listed diameter, they were accurate enough for our purposes. As about three dozen gages of each size were required, the expense of providing gages of the usual type would have run into a large amount, and it was quite possible that we would never have occasion to use such gages in quantities again. By using the Danly dowel pins we were able to make a large saving. For example, the usual ½-inch steel gage costs several dollars; the dowel pins cost $1.62 per dozen, and the pins retained their accuracy longer than we had need of them. The accompanying illustration shows how each set of pins was mounted on a wooden block for our use.

Suggestion Systems

(Continued from page 32)

As for the giving of non-financial awards, several companies have been successful in giving engraved certificates, medals, watches, rings, watch fobs, or in the event the suggestion has to do with safety or some factor of operation interesting to the workman's wife and family, an object for the home such as a mantle clock, floor lamp, radio set, etc. In nearly every instance the giving of such non-financial rewards is staged at the time of some company function such as a dance, musical program, picnic, or other gathering.

The detail or "paper" work connected with a suggestion system should be kept simple and elementary. Naturally the amount of such work, and indeed, the plan of procedure, will vary with the type and size of organizations. Because all forms are entirely interdepartmental, it is not at all necessary that they be expensively made up.

In most cases the only forms needed will be the standard suggestion blanks, envelopes for their transmittal (should secrecy be advisable), form letter for their acknowledgment, and four ordinary folders for the handling and retention of the suggestions in the office.

The clerical work for such concerns involves merely the regular collection of suggestions from the suggestion box and the insertion of these suggestions into a "Suggestions Received" folder until the next scheduled meeting of the Suggestion Committee, at which time disposition is made of the ideas with subsequent filing of the suggestions into one of the three remaining folders: "Adopted Suggestions," "Rejected Suggestions," or "Pending Suggestions."

No chatter marks ~ *when spindles are mounted on*

NORMA HOFFMANN PRECISION BEARINGS

In Demco Sensitive Drilling Machines Spindle Speeds range upto 12000 R.P.M.; Merit Oil Equipment Corporation, Cleveland, Ohio.

The "Precision" inherent in these bearings comprehends those qualities of materials and workmanship and finish which provide the utmost resistance to wear. Rigidity and practically permanent alignment of the shaft or spindle are assured, and clean, accurate work results.

Our Engineers will be glad to aid you in solving troublesome bearing problems. Write for Catalog 917 for sizes, and load and speed ratings.

NORMA-HOFFMANN BEARINGS CORPORATION STAMFORD, CONN., U.S.A.

MODERN Machine Shop

HOWARD CAMPBELL - - *Editor*

How Safe Is Your Plant?

THE first week in October is the period that has been selected by the National Safety Council as "National Safety Week." While plant executives who are planning any special demonstration to focus attention on this subject are probably in the minority, those of the majority can well make an attempt at this time to take stock of working conditions about their respective plants, and discover, if possible, just what is being done to make the plant safe for the employees.

At this time—if no other—a safety meeting should be held in each and every shop throughout the country. Every department head should be required to examine all equipment in his department and make a report, during the meeting, of the condition of the floor, benches, overhead shafting, unguarded belts, unguarded grinding wheels, receptacles for material, and so on. All recommendations should be tabulated and a "safety committee," composed of possibly three foremen, should examine the hazards listed and orders should be issued for the necessary repairs or changes.

Guards should be placed around all belts; guards of "unbreakable glass" should be attached to grinding wheel stands to prevent eye accidents; racks should be provided for bar stock, pipes, and similar materials. Boxes and barrels should be discarded in favor of metal containers for material in process, and means should be found for keeping all materials off the floor. An investigation should be made as to infections from the use of cutting oils, tools that are issued to the workmen should be examined to discover whether or not they are battered. Pieces flying from a battered hammer may destroy an eye instantly.

Such safety measures as those outlined here not only make the job safe for the workmen, but they pay dividends in time saved and in a better spirit of loyalty and co-operation among the employees.

Finance Company Aids American Manufacturers

THE readers of MODERN MACHINE SHOP may be interested to know that the Commercial Investment Trust Corporation of New York City has established a new South American branch at Santiago, Chile, where it will function as a self-contained finance company offering a complete time payment finance service to American manufacturers who are planning distribution in this important section of the southern continent.

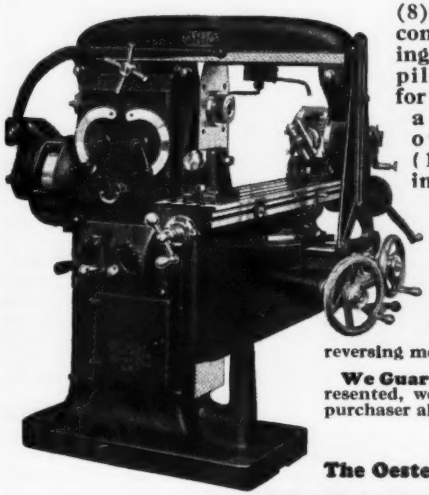
The development of South America is just now at about the stage the United States had reached between 75 and 100 years ago, and has ahead of it all of the processes of expansion, with the attendant opportunities, that this country has passed through in that period of time. Very little machinery is built in South America; practically all of it is purchased from either European or American manufacturers. The American manufacturer of machinery who has not investigated the possibilities in South America is overlooking a good bet.

Save $700 to $1000 on a Miller!

ORDERS were received for as many No. 2 Universal Millers in thirty days at the new low prices as were sold in the preceding twelve months.

With these machines a high standard of accurate milling can be maintained. The standardized spindles are forged from high carbon chrome nickel — every gear, shaft, clutch and stud in the driving and feed mechanism is either pack hardened or heat treated.

Consider these features also: (1) Veeflat overarm; (2) complete interchangeability of arbors, chuck, etc.; (3) fully enclosed motor—readily accessible; (4) quick-stop brake; (5) disengaging hand wheels; (6) automatic lubrication; (7) 16 feeds —16 speeds; (8) sensitive control starting lever; (9) pilot wheel for easy operation of overarm; (10) gauging strip.



No. 2 Ohio Universal Constant Speed $1775

No. 3 Ohio Plain Constant Speed $1880

Either Type Equipped for Motor
$150 Extra

Reasons for Low Prices

1—Increased production makes possible manufacturing economies.

2—*While incorporating every feature essential for economical milling*—these machines run right-handed and do not have reversing mechanism, dual control or frictionless bearings.

We Guarantee—that if these machines are not as represented, we will accept their return and refund to the purchaser all freight, handling and set-up charges.

Write for Miller Catalog

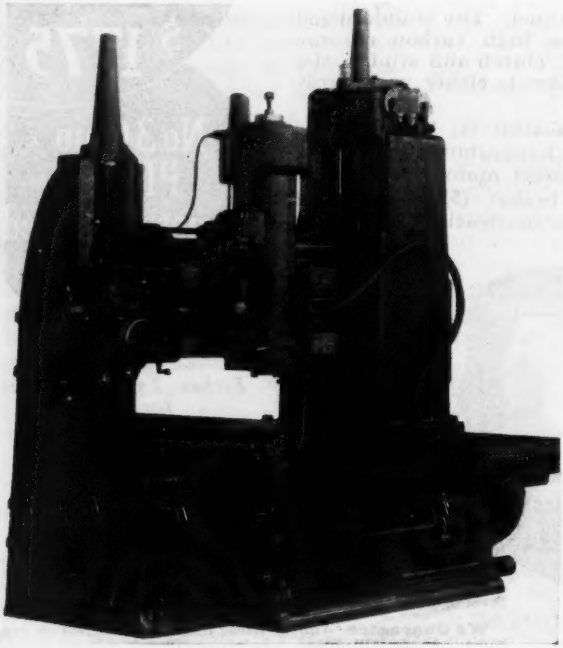
The Oesterlein Machine Co. Cincinnati, Ohio

OESTERLEIN OHIO
MILLING GRINDING DRILLING
EQUIPMENT

New Shop Equipment

Bridge Type Vertical Mil-Waukee-Mil

The exhibit of the Kearney & Trecker Corporation, Milwaukee, Wisconsin, at the National Machine Tool Show includes a new type of unit known as the "Bridge-Type Vertical." This machine has been developed to meet the need for a unit of this kind, and is especially adapted for face milling, die sinking, routing, profile milling, or any other operations where several surfaces on the same piece are to be milled at various planes or levels.

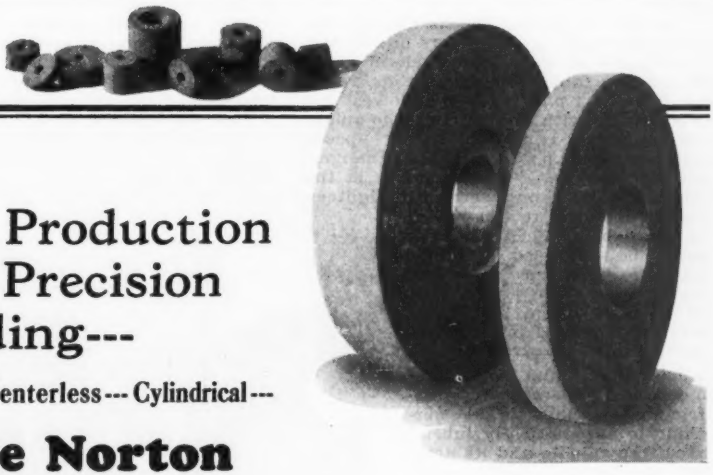


Bridge Type Vertical Mil-Waukee-Mil

The unit can be assembled with any standard 2200 series Simplex (Mil-Waukee-Mil) bed. The table is 22 inches wide and can be furnished in any length of table feed from 3 ft. to 11 ft. The maximum width of work that will pass through the housings is 46 inches. The bridge is fitted to an upright housing similar to the corresponding part on the regular Mil-Waukee-Mil Vertical, but is much heavier in construction. The upright housing is bolted solidly to the bed, and there is a secondary upright housing bolted to the front of the Simplex bed to carry the front end of the bridge. The bridge, saddle and spindle movements are controlled primarily by the same levers with which the usual type of Mil-Waukee-Mil is controlled at the front of the bed. The bridge can only be operated by power, traveling at a rate of 25 inches per minute.

The saddle which carries the vertical spindle ram has 24 inches of horizontal travel along the bridge or rail, and can be moved either at the feeding rate or at a rapid traverse rate of 100 inches per minute. It is possible to engage both the saddle cross feed and the table feed at the same time for diagonal milling.

The spindle ram is fitted to vertical ways on the saddle, which, in turn, is fitted to horizontal ways on the bridge. The spindle ram is provided with 7 inches of power down feed, or it can be run up or down by either quick or slow hand movement. It can be fed down to a minimum distance of 3¼ inches from the end of the spindle to the top of the table, or



For High Production High Precision Grinding---

Internal --- Centerless --- Cylindrical ---

The Norton "D" Wheel

HERE is a modern wheel to meet today's grinding requirements—developed for the grinding of large quantities of identical or similar parts to close limits of accuracy. This Norton "D" wheel is especially suited for internal grinding in the present day types of automatic machines, for centerless grinding and for crankshaft and other high production cylindrical grinding.

It is in structure that the "D" wheel differs from ordinary wheels. And the features of the wheel—its ability to grind very rapidly and very accurately—are due to this difference in structure.

NORTON COMPANY :: WORCESTER, MASS.
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W-260

NORTON
GRINDING WHEELS

raised to a maximum distance of 26¼ inches.

Changes in spindle speeds may be obtained through pick-off gears or through a quick-change gear box. Pick-off gears provide for four ranges of speeds, ranging from 15 r.p.m. with the slowest set to 500 r.p.m. with the fastest. The quick-change speed box provides for speeds from 15 to 300 r.p.m. in eighteen changes, and by changing a pair of gears in the speed-box, a second series of eighteen speeds from 30 to 600 r.p.m. is available. Feed changes may be obtained through pick-off gears or a quick-change gear box, and ranges of from ½ in. to 20 in. per minute or from 1 in. to 40 in. per minute are available.

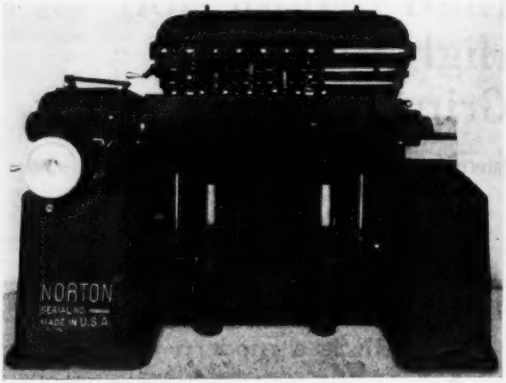
The spindle and its driving mechanism operates in anti-friction bearings. The machine is automatically lubricated, the spindle and its driving mechanism, saddle, feed box, and all other parts being supplied with oil from a pump in the bed of the machine. When desired, the spindle ram can be furnished with 4-position micrometer stops and an indicator dial to aid in the high speed production of interchangeable parts.

Norton Type 50 Crankshaft Lapping Machine

Among the machines shown in the exhibit of the Norton Company, Worcester, Mass., at the National Machine Tool Show is the Type 50 crankshaft lapping machine shown in the illustration. Several new features are included in the design of this machine, including a mechanical elevating table for raising and lowering the work. The shaft is placed on supporting blocks on a table 29 inches from the floor and is raised mechanically into proper alignment with the head and tailstocks. The shaft is instantly located with the driving pin and any great amount of lifting by the operator is obviated. When the operation is finished, the shaft is lowered in the same manner.

The lapping time is also mechanically controlled. The mechanism is set to lap a specified time and when this period has elapsed the operation stops. Thus each shaft is lapped a predetermined amount of time. Another improvement is the construction of the lapping arms, which are now counterbalanced and suspended from a vertical position so that the weight of the lapping arm mechanism will have no influence on the lapping action.

The machine is designed to lap all main bearings and crankpins simultaneously, and has a capacity of 42 in. in length. Abrasive paper, cast iron laps with loose abrasive, or abrasive sticks



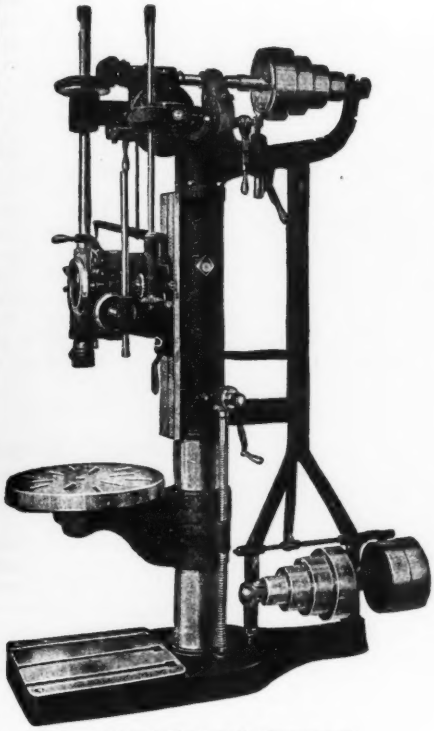
Norton Type 50 Crankshaft Lapping Machine

can be used. The machine is entirely self-contained and is fully equipped with ball and roller bearings.

Norton Model 84 Crankpin Grinding Machine

Included in the exhibit of the Norton Company, Worcester, Mass., at the National Machine Tool Show is the new Model 84 Crankpin Grinder illustrated herewith. The design of the machine is entirely new and includes many features intended to provide a maximum of safety and to reduce the manual effort required to the minimum. Movement of the work holders, table and wheel slide traverse is hydraulically controlled by an interlocking device that renders these mechanisms interdependent. One cannot be moved while either of the others is in operation. This arrangement insures safety to the operator and aids in preventing spoiled work.

Another feature of the machine is the mechanical operation of the steadyrest, which moves upward when unclamped



Barnes 26-inch Drill with Power Feed and Automatic Stop.

Barnes

UPRIGHT

Drills

With Stationary Head—
15, 20, 22½, 25-inch swing.

—

With Sliding Head—
22, 26, 28, 34, 42, 50-inch swing.

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Gang Drills—
20 to 26-inch swing.

Barnes Upright Drills are made in a range of sizes from the 50-inch swing, required in the railroad shop, to the 15 and 20-inch sizes used in the small machine repair shop and garage service.

Arranged for Silent Chain or Belted Motor Drive. With or without Power Feed.

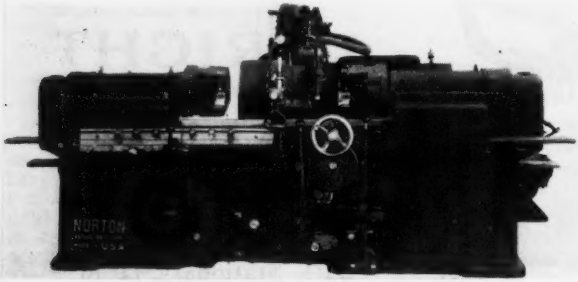
Write for Our Circulars Giving Complete Information

W. F. and JOHN BARNES CO.

ROCKFORD, ILLINOIS

Upright Drills Screw Presses
Horizontal and Vertical Production Drilling and Boring Machines

from the table, permitting easy access to the work. Attached to the steadyrest are splash guards and a Pratt gage, which also move in and out of operating position with the steadyrest. In order to still further reduce fatigue of operation, the machine base has been designed so that the work is supported much closer to the operator and somewhat lower than its usual position, facilitating the handling of heavy crankshafts in and out of the machine.



Norton Model 84 Crankpin Grinding Machine

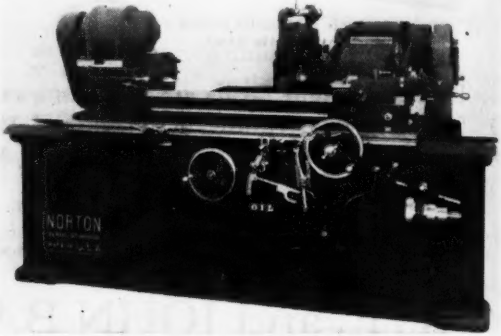
Four adjustments are provided on the wheel slide; fast motion to the shoulder of the pin, controllable feed down the shoulder to the body, fast return to the extreme rear position, and slow motion in both directions for truing to size the sides of the wheel to the correct width or thickness. All controls are easily accessible. The machine is self-contained, a single motor on the rear of the base furnishing motive power. The machine has a swing of 17 inches, and is made in the following sizes: 24 to 30 in., 30 to 36 in., 36 to 42 in., 42 to 48 in., 48 to 54 in., and 54 to 60 inches.

Norton Type A Cylindrical Grinding Machine With Hydraulic Rapid Wheel Slide

The Norton Type A Cylindrical Grinding Machine is now being equipped with a hydraulic arrangement on the wheel slide, which is intended to minimize the amount of hand feed required and speed up production. Fast motion from extreme rear position to a predetermined spot close to grinding position is obtained by moving a control lever. The grinding operation is controlled by hand feed, and return fast motion to extreme rear position is again obtained by the above-mentioned lever. This fast power traverse saves a great deal of time on certain classes of work which require the wheel to be backed to the extreme rear position in order to get the work in and out of the machine.

Type RO "Rite Speed" Electric Polishing and Buffing Lathe

A new development of the Hill-Curtis Company, 1618 Douglas Ave., Kalamazoo, Michigan, is the Type RO Electric Polishing and Buffing Lathe shown in the illustration. Among the features of this machine are the rigid one-piece base and the spindle support with of overhanging design, which is intended to allow a maximum of working clearance



Norton Type A Cylindrical Grinding Machine with Hydraulic Rapid Wheel Slide

"Keep the Spindle Turning"

At the Cleveland Show

YOU saw the advantages of WIZARD Quick-Change Chucks and Collets in actual operation on a modern drilling machine. You saw that it is possible with WIZARD Friction-Drive Tapping Collets to tap blind holes at drilling speed with perfect safety. The latest McCrosky Catalog will help you to determine the WIZARD outfit for a particular job. It will also give you full details about all McCrosky Tools. Send for a copy.

McCrosky Tool Corporation : Meadville, Pa.

WIZARD Quick-Change Chucks

around the spindle. There is a clearance of 12½ inches from the spindle housing to the front of the pedestal, at the floor. The spindle is of chrome-manganese bronze, oversize, and made

Type RO "Rite Speed" Electric Polishing and Buffing Lathe

in one piece. It is supported in four oversize ball bearings or Timken tapered roller bearings, as preferred.

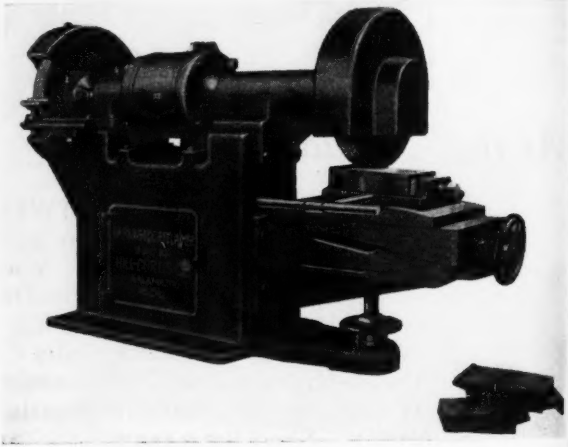
The motor is mounted on the inside of the pedestal, and is arranged to permit adjustment of belt tension from the outside of the pedestal at the rear without disturbing the motor mountings. Perfect alignment between the motor and pulley sheave is assured at all times. Louvers provide for perfect circulation of air, while at the same time keeping out the dirt and dust.

The new Hill - Curtis combination switch and brake is furnished on this machine, insuring fool - proof operation and reducing wheel change time to a minimum. Push button control can be furnished if desired. Power is transmitted from the motor to the spindle by means of Multi-V belts which require no idler to prevent slippage. The lubrication system includes convenient oil cups, oil level gage, and flushing plug.

Hill-Curtis F-B Wedge Reclaimer

A simple but rugged machine for accurately and quickly grinding the correct radius on both new and worn journal wedges has been developed by the Hill-Curtis Company, 1618 Douglas Ave., Kalamazoo, Mich. The machine is equipped with a profile block, the top of which is machined to the proper radius for journal wedges, and on this machined surface is a chuck that will hold any standard A. I. A. wedge. The chuck, with the journal wedge locked arm, projects toward the front of the machine and is guided under the wheel by means of a feather key which fits in guiding slots planed in the top of the profile block. After one section of the wedge radius has been ground, the chuck is moved over on the profile block until the feather key in the chuck slides in the next slot. This operation is repeated until as much of the surface of the wedge is ground as is necessary to reclaim the proper radius.

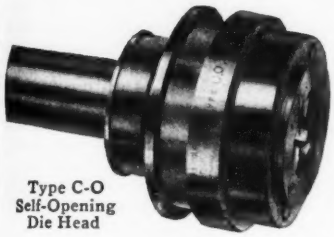
The amount to be ground from the wedge is controlled by the hand wheel at the extreme right of the machine. This hand wheel operates the screw that moves the adjusting block between the profile block and the base of the machine on an inclined way, thereby raising and lowering the wedge in rela-



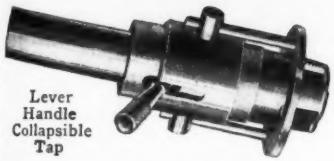
Hill-Curtis F-B Wedge Reclaimer

MURCHEY TOOLS

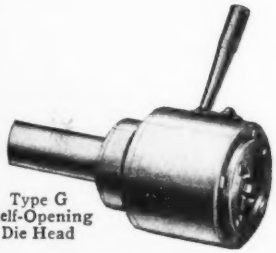
Keep Threading Costs Low!



Type C-O Self-Opening Die Head



Lever Handle Collapsible Tap



Type G Self-Opening Die Head

Low threading costs depend upon the ability of threading tools to produce accurate threads at high speeds.

MURCHEY Collapsible Taps and Self-Opening Die Heads enable the fastest equipment to turn out accurate threads at top speed. They are built to successfully meet the demand of high speed equipment and will materially increase production on modern threading machines.

If you have a problem of reducing threading costs submit it to MURCHEY. There are forty-six sizes of MURCHEY Collapsible taps and fifty-five sizes of Self-Opening die heads from which we can solve your problem.

The MURCHEY Catalog describes these tools fully. Get your copy NOW!

MURCHEY MACHINE & TOOL COMPANY

951 PORTER STREET, DETROIT, MICHIGAN

MURCHEY AGENTS

Cleveland Office, 4500 Euclid Ave.; Pittsburgh, Machinists' Supply Co., 325 Second Avenue; Chicago, R. E. Ellis Engineering Co., 621 Washington Blvd.; Haviland Wright, 307 N. Broad St., Philadelphia, Pa.; J. Van Doren, 52 Vesey St., N. Y. C.; Kemp Machinery Co., 215 North Calvert St., Baltimore, Md.; Machinists Tool Supply Co., 414 E. Third St., Los Angeles, Calif.; R. C. Neal Co., 76 Pearl St., Buffalo, N. Y.; 46 Andrews St., Rochester, N. Y.; 569 So. Clinton St., Syracuse, N. Y.; Coats Machine Tool Co., 14 Palmer St., Westminster, London, S. W., England.

tion to the grinding wheel. The whole wedge-reclaiming end of the machine can be raised and lowered to compensate for wear by means of a vertical screw and hand wheel.

Power is supplied through an especially-designed 5 h. p. motor of the 40-degree Centrigrade type, which will stand momentary overload of 100 per cent. The motor is totally enclosed, having no hole or open slots through which dirt or dust might enter. An automatic starter with remote push button control is mounted in the pedestal.

The machine spindles are made of nickel steel, accurately ground and balanced. High grade, oversize ball bearings or Timken Tapered roller bearings will be supplied as preferred. The bearings are mounted in end caps in closest proximity to the grinding wheels, and are completely enclosed by double labyrinth seals. The right hand wheel is concave and is of a grain and grade best adapted for grinding wedges. The left hand side of the machine is designed for a straight wheel 18 x 3 in., for tool and production grinding. The wheel guards are of steel and comply with all safety codes.

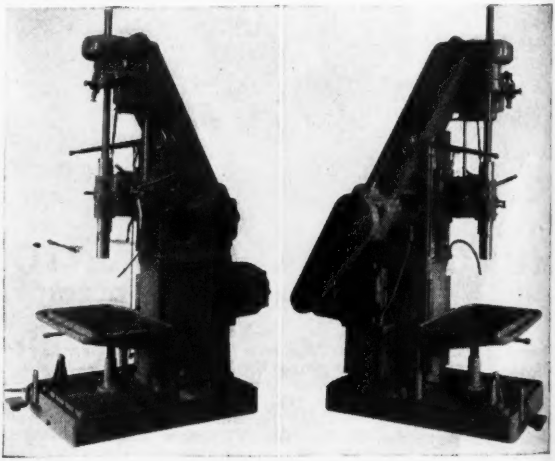
Barnes No. 262 Sliding Head Self-Oiling Drilling and Tapping Machine

Among other new machines which the Barnes Drill Company, of Rockford, Ill., is exhibiting at the Machine Tool Show in Cleveland, is the new No. 262 Sliding Head Self-Oiling Drilling and Tapping Machine shown in the illustration. The machine is exceptionally rugged with column and head of box-section construction, which provides for a maximum of strength and rigidity.

Eight speeds are obtainable with quick change gears, the lever controls extending to the front of the machine for convenience of operation. Eight spur-geared feeds, quick change, are also obtainable with lever controls at the front of the machine. The speed and feed changes are plainly indicated on brass plates. The spindle is of six-spline construction, 2 inches in diameter, and is provided with roller thrust bearing of unusual strength and endurance. The spindle sleeve is fitted with the Barnes patented dovetail construction rack, in which the use of screws is eliminated. The regular spindle travel is 15½ inches, but travel can be varied to suit. A split bearing is provided for the spindle sleeve, providing for taking up for wear whenever necessary. The cap is of Gunite metal and is provided with laminated shims.

All bearings are of the anti-friction type, and every bearing is automatically oiled through the self-oiling system. The transmission bearings are Timkenized, and the cross spindles and driving shaft have ball bearings. The spindle thrust is taken by an unusually strong roller bearing, having a double set of rollers.

The machine is 94 inches high; dimensions of table for square column machine, 18 x 28 in.; vertical travel of table, 17½ in.; vertical travel of spindle at any position of head, 15½ in.; travel of sliding head, 19½ in.; maximum distance from spindle to base, 15½ in.; maximum distance from spindle to table, 38 in.; speed of driving pulley, 400 r.p.m. Floor space required, 30 x 53 inches. Net weight with 5 h.p. motor, 3,500 pounds.



Barnes No. 262 Self-Oiling Drilling and Tapping Machine

Twin Disc Presents New Machine Tool Clutch

A NEW, more compact type of machine tool clutch, suitable for single or duplex installation, is announced by Twin Disc.

Its superior performance has been demonstrated in exhaustive tests made under the most difficult conditions met in actual practice.

This new clutch is offered as a distinct step forward in machine tool clutch design and construction. It will be known as Type C.C. Full information about sizes and capacities will be sent on request.

TWIN DISC CLUTCH COMPANY

RACINE WISCONSIN

Twin Disc "C. C." Type Multiple Disc Clutch

A new type of multiple disc clutch, known as the "C. C." type, has been announced by the Twin Disc Clutch Co., Racine, Wis. This clutch is the result of a considerable amount of development

Twin Disc "C. C." Type Multiple Disc Clutch

work that has been done by this company in an effort to produce a multiple disc clutch designed to run in an oil bath, and which, while embodying the characteristics of the type, would be free from any of the inherent difficulties that, under certain conditions, have arisen in operation.

The clutch is made in sizes from 3½ inches effective diameter of friction discs up to 6 inches, varying by half-inches, also in 7, 8, 9, 10, and 12-inch effective diameters. In the smaller sizes all parts are machined from the bar except the driving plates, which are of hard rolled phosphor bronze. All steel frictional surfaces are hardened and ground, and exceptional care is taken to insure the straightness and parallelism of the driving and driven plates.

Centrifugal force is utilized to release the pressure levers, which are housed in the hub itself. These pressure levers are operated by sliding wedges which are also guided and housed in the hub. No cotters or similar devices are used in the assembly, and it is impossible for any part of the clutch to become detached without deliberate disassembly. When installed there are no projecting parts, all visible portions being circular and the design as a whole is exceptionally compact, especially in view of the high capacities developed. The Twin Disc Company's well-known method of adjustment is applied in a modified form to the smaller models, and is retained in its usual construction in the larger sizes.

Kent-Owens No. 2 Power Feed Miller

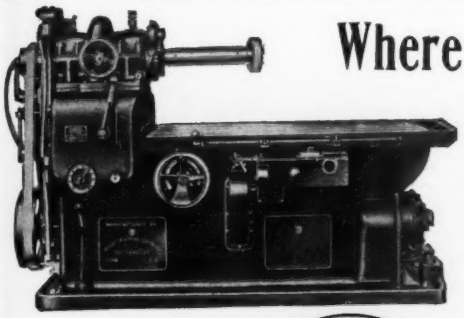
The illustration shows the new No. 2 Power Feed Miller, which has been placed on the market by the Kent-Owens Machine Co., Toledo, Ohio. The machine is of column and knee construction, but with the spindle mounted in a head which can be fed vertically.

The spindle drive belt direct from the backshaft is equipped with an idler to maintain the proper belt tension for all positions of the head. Both the spindle and backshaft are mounted on Timken tapered roller bearings. Pickoff gears, mounted in the case shown on the machine, provide for the different spindle speeds. The drive can be taken either direct from the countershaft to a two-step cone pulley on the backshaft or by chain from a motor mounted on the right hand side of the column.

Power feed and quick return to the

Kent-Owens No. 2 Power Feed Milling Machine

table are provided, although the table hand feed is available for use for light or short cuts. Pickoff gears provide for a wide range of table feeds. A heavy



Where Accuracy Counts

. . . . That, of all places, is in the building of a mechanical product in which precise measurements and perfect running clearances are essential to successful performance.

These results are positive when you employ Micro Internal Grinders. Many modern machine shops are profiting by the speed, accuracy and economy with which Micro Grinders handle the work. What is the nature of your grinding problem? There's a Micro Internal Grinder built for your requirements.

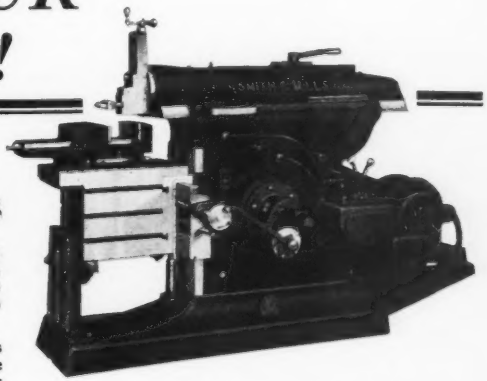
Micro Model "DG," a general utility grinder with slotted table to accommodate work mounting fixtures.

GRINDERS Micro

MICRO MACHINE COMPANY

Bettendorf — MANUFACTURERS AND DESIGNERS OF *PRECISION GRINDERS* FOR ALL PURPOSES — Iowa, U-S-A

CUT YOUR COSTS!



SMITH & MILLS
HIGH SPEED
CRANK SHAPERS

are designed for accurate work at high speeds. They shorten production time which cuts your operating costs. Smith & Mills shapers are equally efficient on tool room or production work.

Smith & Mills modern improvements include "V" type ram with 55 degree ways, splined shafts, heat-treated alloy steel gears, speed box shafts mounted on Timken tapered roller bearings, Twin Disc Clutch, and one shot lubrication system.

Made in 16, 20, 25 and 32-inch sizes back geared; single-geared in 12 and 14-inch stroke.

WRITE FOR CATALOG!

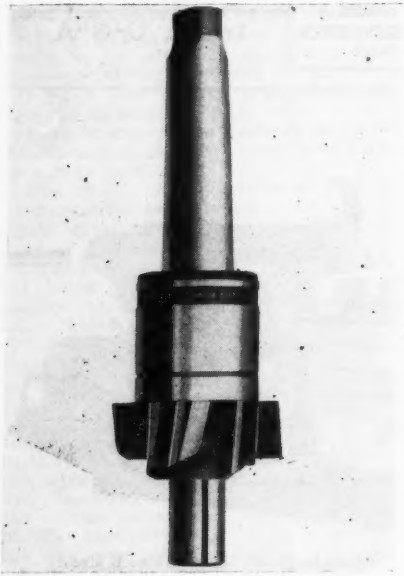
THE SMITH & MILLS CO., Cincinnati, Ohio

flywheel-type pulley is used on the spindle to prevent chatter, and the entire head assembly is counterbalanced. Hand operating levers are conveniently placed and the lever to the head is adjustable to two lengths to provide for either heavy or light cuts. Adjustable stops limit the head travel, and trip dogs engage or disengage the table feed.

The table working surface is 7 x 28 inches, which, with the unusually large trough surrounding it, makes the overall dimensions 14 x 35 inches. The maximum distance from the spindle to the table is 17⅛ inches. The hand feeds to the table and head are 4¼ inches and 6⅓ inches respectively. Net weight, 2,600 pounds.

Eclipse Special Multi-Diameter Cutter

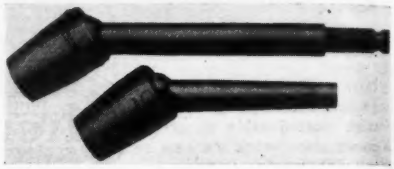
The display of the Eclipse Interchangeable Counterbore Co., 7410 St. Aubin Street, Detroit, at the Machine Tool Show in Cleveland, includes a special Eclipse multi-diameter cutter, shown in the illustration. The tool faces, chamfers, counterbores, chamfers again, and core drills — from the rough — a transmission cover plate for an automobile. The tool is made of the usual high-grade steel, and is finished with the usual high grade of workmanship that is characteristic of this company.



Eclipse Special Multi-Diameter Cutter

Apex Universal Joint Nut Setter

Apex Universal Joints have been adapted to setting nuts and cap screws in inaccessible places, the socket end of the joint being made to fit over the nut, and the shank on the ball end being made to specifications as to length, shape, and so on. The advantage of this tool is in its strength at extreme angle, it being possible to set nuts tight enough in one operation, where formerly they were run onto the thread in one operation and tightened in a second operation.



Apex Universal Joint Nut Setter

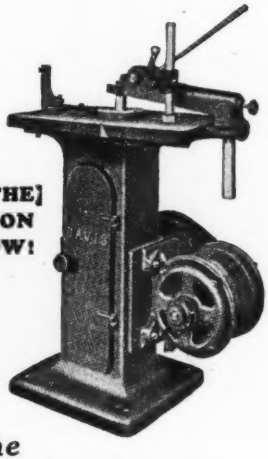
The tools are made of special alloy steel and will operate up to 30 degrees. The illustrations show the straight shank for welding to hand braces, and the special long shank with hexagon end for use in portable tools. The tools are made by the Apex Machine Company, 305 Davis Avenue, Dayton, Ohio.

Apex Floating Tool Holder

The interior design of the full and semi-floating tool holder recently brought out by The Apex Machine Company, 305 Davis Ave., Dayton, Ohio, is fully shown in the illustration. An angular float is obtained by the parallel arrangement of the upper rows of balls with the lower rows, there being two rows of balls at right angles in each case. The balls operate in hardened and ground grooves, eliminating all friction and making the tool absolutely free-floating. The semi-floating holder has a parallel float as only the lower row of balls is used.

The holder allows the reamer to follow the hole, thus correcting any misalignment of the work with the spindle

Have You Investigated



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The Davis Keyseater

WHILE the Davis Keyseater can be profitably employed on quantity production for a standard part, two minutes is all the time required to change over for each item of a run of mixed work. Its capacity is from 1/16 inch to 1 inch, and cuts tapered or straight Keyways with equal efficiency.

The Davis "Two-Minute-Set-Up" means maximum production. Investigate this method now!

DAVIS KEYSEATER CO.
250 MILL STREET, ROCHESTER, N. Y.

I am interested in the Davis Keyseater. Send me Complete Catalog.

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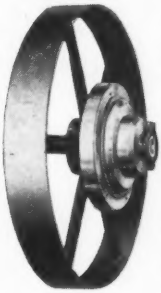
M.M.S. 10

Do Conway Clutches Increase Production?



LISTEN TO THIS!

ON a machine tool built expressly to machine valve castings, production was fifty (50) per day. The factory superintendent* was satisfied with the production, but he was, on the other hand, thoroughly disgusted with the "bang it in" and "drag it out" make and break of the clutch controlling the drive. So — the clutch was replaced with a Conway Disc Clutch Pulley.

Production increased from fifty (50) to seventy-nine (79) pieces per day, and all the other machine operators in that department are clamoring for Conway Disc Clutch drives.

Easy engagement, instant release, drag-free idling, power capacity and centripetal action—co-ordinated excellently into splendid start, go and stop—that enhances operator morale — which in turn increases production.

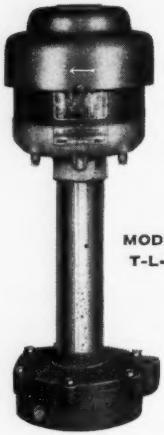
But there is more to the Conway Disc Clutch than this. Get out our bulletin DC and take a look at the last word in friction clutches.

* *Name given on request.*

The Conway Clutch Co.
1959 W. 6th St., Cincinnati, Ohio

"The Conway Disc is a Splendid Clutch."

"GUSHER"
Coolant Pumps

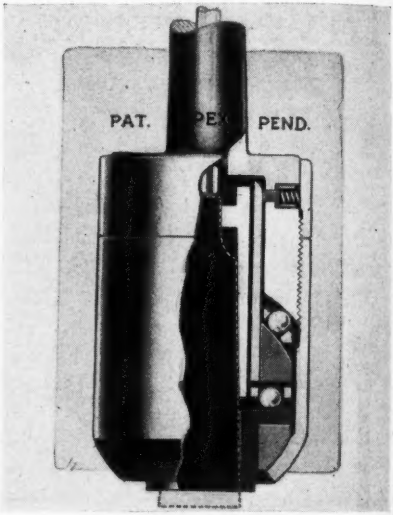


will help you sell your machines. They are standard equipment on many nationally known makes.

Write for Information

The Ruthman Machinery Co.
532 East Front Street
CINCINNATI, O.

or turret, and eliminating bell-mouthed or tapered holes. Taps used with this holder will tap true to size. The in-



Apex Floating Tool Holder

serted socket type of shank has been provided to reduce the overall length of the tool. This type, with either Morse taper or straight hole, is particularly adaptable for hand screw machines and automatics on account of the short overhang.

Apex Friction Chuck for Electric and Air Tools

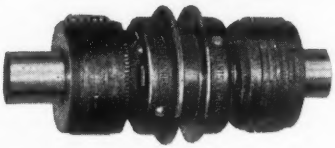
The multiple disc safety friction chuck manufactured by the Apex Machine Co., 305 Davis Ave., Dayton, Ohio, is now

Apex Friction Chuck for Electric and Air Tools

being furnished with shank to fit any electric or air tool, and with a hole in the bottom to take any make of socket

The

PULLMORE *Industrial* CLUTCH



WOULD YOU CONSIDER—

EFFICIENCY which removes clutch troubles and complaints? The PULLMORE does!

ADAPTABILITY which permits clutch application on the most correct and approved principles? That's possible with the PULLMORE!

COMPACTNESS that reduces the necessary clutch space to a minimum without sacrificing efficiency? The PULLMORE is the smallest clutch made, capacity as a basis!

ADJUSTMENTS that are required very rarely but when necessary can be made with exceptional ease and no special tools? A screw driver is sufficient to make the finest adjustments which are few and far between on the PULLMORE!

PULLMORE CLUTCHES are built with capacities from 2 to 25 h. p. at 500 r. p. m., varying with the r. p. m., in single or double type to run dry, or in an oil bath. A trial installation will convince you!

WRITE FOR DETAILS

THE ROCKFORD DRILLING MACHINE CO., Rockford, Ill.

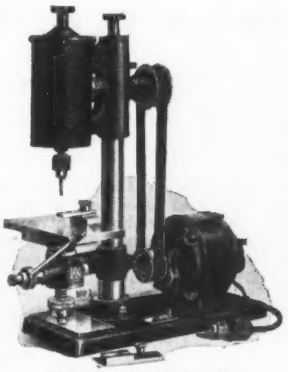
REDUCE TAP BREAKAGE

With This

NEW "A. M." SENSITIVE TAPPING MACHINE

It is so well balanced, and sensitive that it will drive the smallest tap with less danger of breakage than is usually encountered in tapping by any other method. Any tap from the very smallest up to 3/16" diameter in ordinary steel or iron, and up to ¼" diameter in softer metal, can be operated efficiently with this machine.

It is motor driven, entirely self contained, and has many features that result in accurate and economical performance.



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ADOLPH MUEHLMATT

FIFTH AND ELM STS., S. E. CINCINNATI, OHIO

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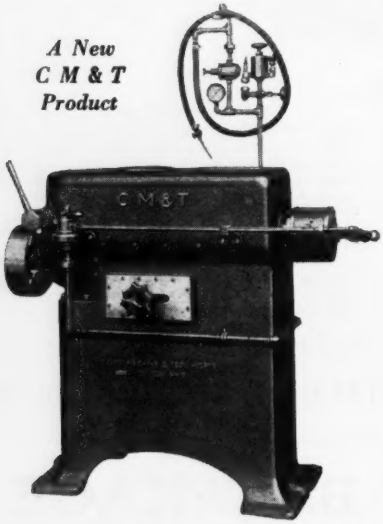
GEAR BURNISHER

A New C M & T Product



FOR BETTER RESULTS!

BURNISHING GEARS with a "BOLENDER" Gear Burnisher produces a uniform size and finish, improves the accuracy of the gear, and burnishes all gears between 1½-inch and 8-inch diameter up to 11½ inches long.

The new design, the heavy rugged construction and the use of proper materials, coupled with a centralized control of all operating and adjusting members, insures better results by using the BOLENDER Gear Burnisher.

Chamfering Machines, Grinding Chucks

City Machine & Tool Works

5 North June Street

DAYTON OHIO

wrench, screw driver bit, or similar tool. The photo shows the friction chuck with hexagon shank and hexagon hole in bottom. When the friction is set to the desired tension, a uniform setting is obtained, the friction slips preventing damage to the electric tool. The chatter and vibration of the clutch is entirely eliminated. Nut setters made of special alloy steel, stud setters with alloy steel sleeves, and screw driver bits are furnished with shanks to fit any make of electric or air tool.

Davenport Universal Die-Holding Stand

The Davenport Universal Die-Holding Stand is a new die shop tool recently announced by the Davenport Locomotive & Manufacturing Corporation, Davenport, Iowa. The stand is designed for holding die blocks while in process, and to facilitate the work of the die maker by enabling him to set the block at

Davenport Universal Die-Holding Stand

any desired height or angle without physical handling. The Universal Die-Holding Stand is built in two standard sizes, to accommodate blocks weighing

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Lower Production Costs

These thoroughly tested centers have the required accuracy for all turning and grinding jobs. They are suitable for high or low speeds, light or heavy loads—and have been used as standard equipment for many years in prominent plants throughout the country.

Tungsten Carbide tools hold no terrors for "Nielsen" Centers. They are guaranteed against defects in material and workmanship.

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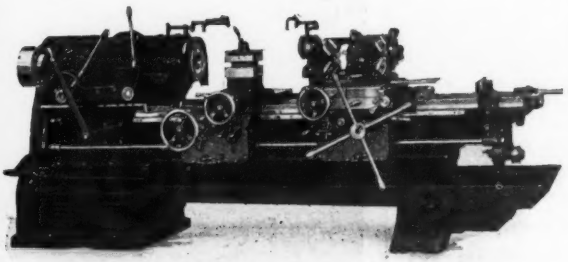
NIELSEN, INC.
LAWTON MICHIGAN

No. 3 Acme Heavy Type Universal Turret Lathe with DUO CONTROL

Higher operating efficiency, together with simplified design, makes this Acme Turret Lathe an unequalled producer on all work within range.



DUO CONTROL Turret Lathes Built in These Sizes

No. 1 — Semi- and Full Universal, 2½" capacity.

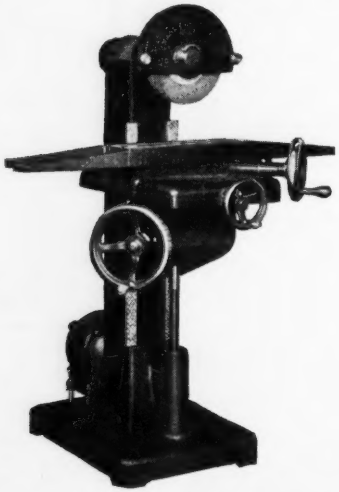
No. 2 — Semi- and Full Universal 3¼" capacity.

No. 3 — Semi- and Full Universal, 3½" spindle capacity.

17" and 4½" Semi- and Full Universal, 4½" spindle capacity.

THE ACME MACHINE TOOL CO., Cincinnati, Ohio

GRAND RAPIDS No. 1



Surface Grinder

provides an ideal means of handling the small miscellaneous jobs that are constantly coming up in the ordinary tool room. It is particularly suited for grinding small work where short longitudinal table strokes are required.

In the hands of a competent operator, the Grand Rapids No. 1 Surface Grinder can be depended upon to exceed the production possibilities of anything in the automatic surface grinder line except the latest type of hydraulic feed machines.

You will find the Grand Rapids No. 1 Surface Grinder to be a high grade hand feed precision machine.

Write for Bulletin!

GALLMEYER & LIVINGSTON CO.

348 Straight Ave., S. W.
GRAND RAPIDS, MICH.

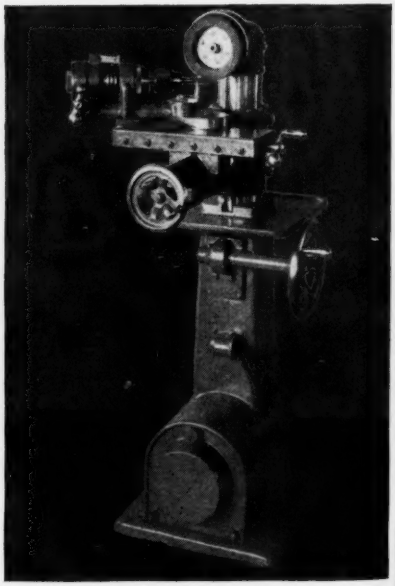
up to 1,500 pounds and 3,000 pounds, respectively.

The multi-angle head fixture is made with an adjustable clamp on either side, which slides in accurately-machined and fitted T-slots. The die is held firmly in place by six machine screws, which project through these clamps and engage the tongue on the die block. The head fixture is actuated by a worm and segment gear, operated by a convenient hand wheel. Any position may be achieved quickly by simply turning the hand wheel until the desired angle is reached, then swinging the entire top assembly — which is completely pivoted. The work is then locked in this position.

The Davenport Universal Stand is exceptionally rugged in all details. The head fixture is of high quality steel, and the base is a circular, one-piece casting, provided with four holes for fastening to the floor.

Oliver Tap Grinder

The Oliver Instrument Company, Adrian, Michigan, has developed a tap grinder which, it is claimed, provides a



Oliver Tap Grinder

ENGINEERING DESIGNING

of

TOOLS - JIGS - DIES - FIXTURES

and

SPECIAL MACHINERY

Specialists In General Production and Contract Work

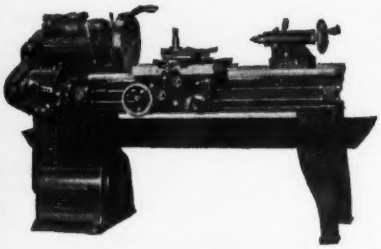
THE STEEL PRODUCTS ENGINEERING CO.

SPRINGFIELD, OHIO

"Makes a Larger Size Sweat"

Rush work in the shop of one of our customers last winter put some extra heavy high speed turning on one of his Rockford Economy Lathes. The highly satisfactory performance on this job inspired the comment "some of the work done on the Rockford Economy Lathe makes a larger size sweat."

We don't recommend overloading any machine tool, but we do design and build Rockford Economy Lathes so well that they will perform perfectly on all work within their rated capacity and carry emergency overloads successfully.



Rockford Economy Lathes have Timken bearings in geared headstocks, Twin Disc Clutch, spindle brake, quick change gear box, apron control of clutch and brake as standard equipment on the 16" size. They are strictly up-to-the-minute and a whole lot of lathe at a very attractive price.

Write for new circular.

OTHER PRODUCTS

Hy-Speed Shaper *Shaper-Planer*
Drilling Machines

ROCKFORD MACHINE TOOL CO.

2414 KISHWAUKEE STREET **ROCKFORD, ILL.**

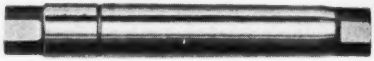
practical method of grinding two-, three-, or four-fluted taps having shanks less than one inch in diameter.

The machine consists primarily of a hollow spindle journaled in ball bearings and mounted in an oscillating frame. The motion of the frame is controlled by cams contacting a fixed roller, which may be quickly adjusted to accommodate the various kinds of taps. The tap to be ground is held in the chuck by the shank—in the same manner in which it is held in a tapping machine—and no center is necessary. The chuck is mounted in the spindle and is held by a knurled nut at the back. A lip rest locates the cutting edge of the tap on the center line.

An index plate having 12 notches provides a means of accurately indexing two-, three-, or four-fluted taps, also a means of locking the spindle while mounting the tap to be sharpened. The spindle is revolved by means of a pair of helical gears and a crank, and the entire mechanism may be swung about a graduated base to obtain accurate angles for taper, plug, or bottoming taps. Right or left hand taps are ground the same way with the same setting of the head, it being only necessary to locate the cutting edge of the tap at the center line. Power is supplied by a ½-h. p. motor in the base of the machine. This machine will be shown for the first time at Booth 1-W-6 at the National Machine Tool Builders' Show in Cleveland, September 30 to October 4.

Ampco "4-in-1" Mandrel

The Ampco Twist Drill Company, Jackson, Mich., has recently placed on the market a tool known as the "4 in 1" Mandrel, for general machine shop use

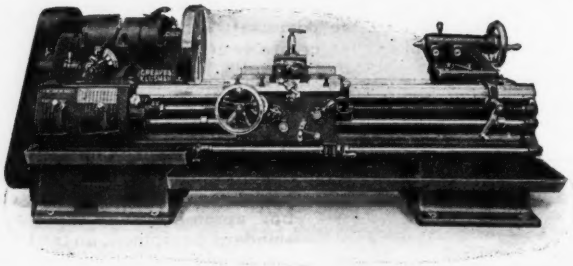


Ampco "4 in 1" Mandrel

as a feeler gage, plug gage, standard mandrel, and micrometer check. One end of the "4 in 1" lathe mandrel is abruptly tapered, in addition to the taper at the regular mandrel end, to determine the amount of cut necessary before taking the final cut in boring or grinding a piece of work. In order to determine whether the desired size has been obtained, the plug gage end of the

G-K Single Lever Control

Flexible Motor Drive



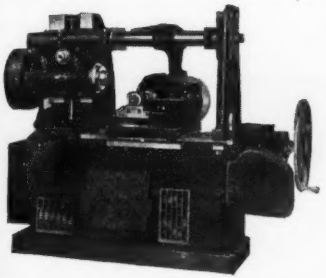
Built In Six Sizes

—helps to increase production as it simplifies operation. Instead of searching through several combinations of levers, any speed of an extremely wide range can be instantly selected through one lever. An index plate shows at a glance how to obtain the desired speed.

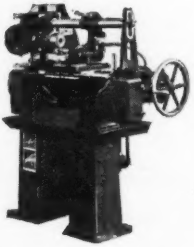
There are many other production-increasing features built into G-K Single Lever Control Lathes. They are fully described in the G-K Catalog. SEND FOR YOUR COPY NOW!

The GREAVES-KLUSMAN TOOL CO., Cincinnati, O.

SERVICE *Is Our Motto* QUALITY *Our Creed*



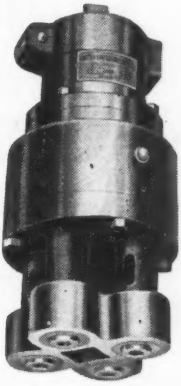
HOBBING MACHINES *by* BARBER-COLMAN *of* ROCKFORD



4 SIZES of Hobbing Machines . . . two sizes "universal" type for spur and spiral gears, sprockets, ratchets, splined shafts and other hobbed forms . . . two sizes for high production on spur gears and splined shafts only . . . Quality Products . . . Send for our circulars.

BARBER-COLMAN COMPANY

General Offices and Plant, *Rockford, Ill., U.S.A.*



Multiple Units

From Single Drills

Designed to fit any type of drill press, a U. S. Drill Head converts any single spindle drill into a multiple unit quickly.

No time wasted making adjustments—spindles are fixed. Any number of holes, fifty if necessary, can be drilled as easily as one.

We will design a U. S. Multiple Drill Head to meet your individual requirements. Tell us your needs. Address

The United States Drill Head Co.

1954 Riverside Drive

Cincinnati, O., U. S. A.

Test It Out Yourself

NO obligation! Get one of these amazing Quick-As-Wink Couplings immediately on approval. Put it to work. Use it and abuse it. It swivels freely and won't leak. It will stand the hardest knocks and can be properly connected in only 30 seconds. Mud, snow or ice have no effect upon it.

One will be mailed to you to try out right on your own job. See for yourself how the use of Quick-As-Wink Couplings will lower maintenance cost, get four times as much service out of one coupling and will speed up work.

SEND TODAY!

C. B. HUNT & SON
639 McKINLEY AVE., SALEM, OHIO

The Famous Tobin Bronze
Quick-As-Wink
HOSE COUPLING
For Any Hose Connection

mandrel is used, which is adaptable to general plug gage uses. It is claimed that this tool is accurate to .00005 inch.

When it is necessary to perform operations on the outside diameter or face of the piece, it is slipped on the mandrel portion of the tool and placed between

Using the Ampco "4 in 1" Mandrel as a plug gage.

centers. To check a micrometer at various intervals of sizes, the "4 in 1" is said to take the place of a complete set or range of micrometer checks. Stock sizes of the "4 in 1" range from 1/4 inch to 2 inches with special sizes furnished to order.

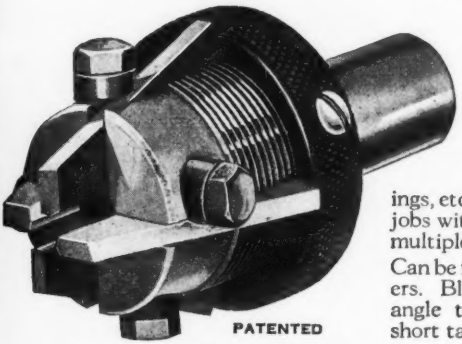
"Thiel" Precision Die-Filing and Sawing Machine

The "Thiel" Precision Die Filing and Sawing Machine, which is shown in the accompanying illustration, is now being marketed in this country by Marburg Brothers, 90 West Street, New York, N. Y. This machine is designed especially for making dies, jigs, templates, cams, punches, forming and drawing tools, and all other similar work where accurate sawing and filing is required, and is especially adaptable for sawing out or finishing small irregular holes.

The machine is unique in respect to the manner in which the saw or file is held. As will be seen by reference to the illustration, the upper and lower

Genesee Adjustable Hollow Mill

Made in 7 different styles



PATENTED

Has adjustable, replaceable blades and can be replaced at nominal cost, making it unnecessary to continually buy new tools.

The ideal tool for finishing your forgings, castings, etc. Do your several operation jobs with Genesee inserted blades multiple operation tools.

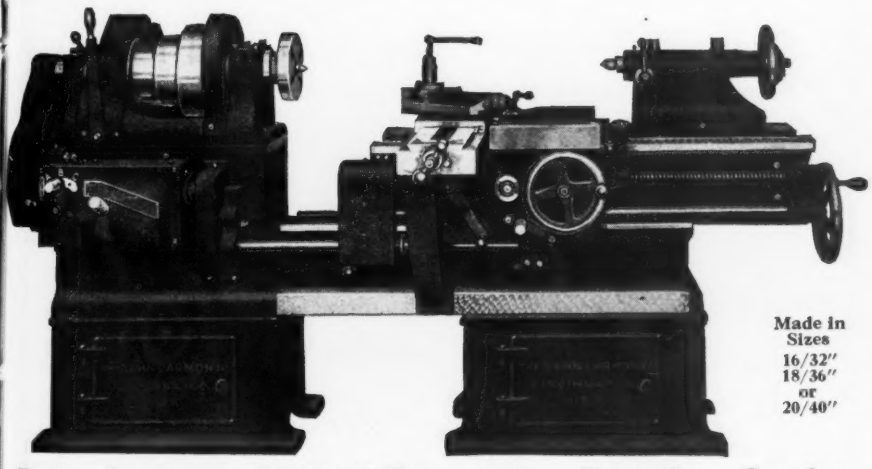
Can be fitted with drills and reamers. Blades can be ground any angle to point work and turn short tapers.

A Genesee Adjustable Hollow Mill can be made for every job

WRITE FOR CATALOGUE

GENESEE MANUFACTURING CO., Inc.

ROCHESTER, NEW YORK



Made in Sizes
16/32″
18/36″
or
20/40″

Rahn-Larmon 18/36″ Extension Bed Gap Lathe

A lathe for large or small swing work, ready at all times. Requires no extra rigging up. Takes different distances between centers.

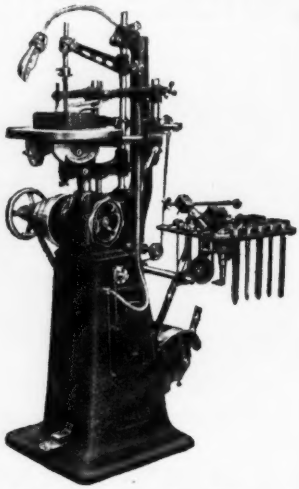
Belt driven or with nine speed all geared motor driven head. Tell us what your requirements are and let us quote you.

THE RAHN-LARMON CO. 2935 Spring Grove Ave., Cincinnati, Ohio

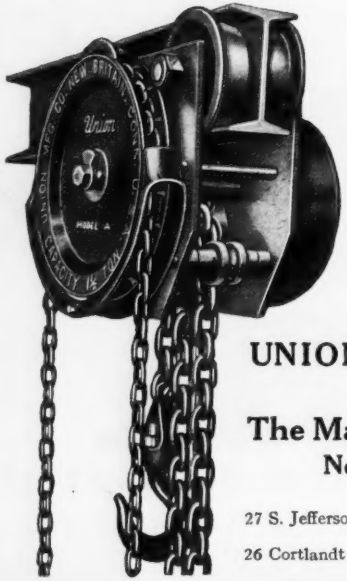
arms, which support the tool, are mounted on a spindle that is rigidly held by bushings above and below the work table. This construction insures perfect guidance of saws or files. The upper arm can be set as desired, which permits of shortening or lengthening the holding frame. The manner of holding the files varies with the size of file used; thin files are held under tension, like a saw blade, while larger profilers are held by clamping in ring-shaped holders. The saws used are of two distinctly different shapes; i. e., short lengths and coils. The short length saws are held in the same holder as the files, the coil saws being held in magazines furnished with the machine.

The table is easily raised or lowered to suit the character of the work, and can be tilted to any angle up to 15 degrees in either of four directions, making it possible to file or saw on a taper in any direction. Adjustable holders are provided for holding the work, while at the same time allowing it to move in accordance with pressure exerted by the automatic feeding device, or by hand.

With the exception of the smallest size, the machines are equipped with both hand and automatic feed, the automatic feed consisting of a weight suspended in the column which pulls



"Thiel" Precision Die-Filing and Sawing Machine.



Union Hoists and Trolleys
Spur Geared and Army Type

Sizes ½ to 20 ton capacity

UNION CHAIN HOISTS are the choice of industry, because of their *Everlasting durability* combined with *Unusually Easy-working* qualities and freedom from ordinary chain hoist troubles.

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— MADE BY —

The Makers of UNION CHUCKS

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FOR THE "TOUGHEST" METAL WORKING CONDITIONS

The Unique Ability of Stuart's Thred Kut

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Alloy Steel Cutting Oil

To "Smooth-Out" Tough Jobs

should be remembered when you are in trouble.

New 64 page booklet (illustrated) mailed upon request.

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CHICAGO. U.S.A.

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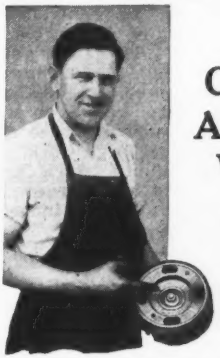


New Cushion Abrasive Wheel

SPECIAL BULLETIN AWAITING YOUR REQUEST

HERE'S the greatest advancement in a single step that the buffing industry has ever achieved. With this amazing Quick-As-Wink Wheel all the disadvantages of rag-buffs are completely eliminated. It uses specially clipped strips of abrasive cloth of any grain, a change of which can be made in 30 seconds. Operates at a normal speed of 3,450 R. P. M., but is absolutely safe at over 6,000 R. P. M. Total width of buffing surface is constantly utilized. Wheel is unbreakable and strips will not burst. Wheel perfectly balanced, every operation safe, and all working parts guaranteed.

Cuts Buffing Costs 50%

Write for details of construction and complete information that show you how 50% of your buffing costs can be lopped off with this efficient, speedy tool. Send a sample of your work with your request for information if you so desire.

C. B. HUNT & SON

639 McKinley Ave. Salem, Ohio

Quick-As-Wink BUFFING WHEEL

the work toward the file or saw. The automatic feed can be controlled to operate either steadily or during the downstroke only. Chips are blown away by an air current, keeping the work clear. Four speeds are available, providing for a large range of work. The machines are made in three sizes, for small, medium and large work. The smallest machine admits work up to about 2 inches thick, the largest machine taking work up to 5 inches in thickness.

Lewis-Shepard "Footlift"

The "Footlift" is a new type of lift truck, designed and built by the Lewis-Shepard Company, 185 Walnut Street, Watertown Station, Boston, Mass. This truck differs from the usual type of single-stroke hand lift truck, in that the weight of the operator is utilized to elevate the load. The lifting mechanism design of the truck is based on the "jack" principle, the load being lifted when the operator steps on a lever.

Lewis-Shepard "Footlift"

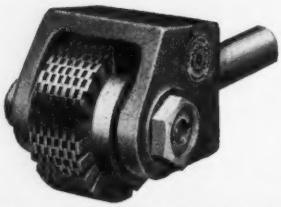
The truck is simple in construction, with all members of heavy duty materials. Several new safety features and a vertical release check are features of the design. The handle is used only for steering and hauling, and a simple twist in the upright position locks it to prevent falling when not in use. The handle has no connection with the lifting mechanism. The operator can stand close to the load when elevating it, so practically no head room is required in which to operate the lifting mechanism.

New Skinner Chuck Catalog

Catalog No. 42, issued by the Skinner Chuck Company, New Britain, Conn., has been prepared for the trade with the idea that it shall serve as a useful source of information as well as a silent representative of the "Skinner" line of products. The book contains descriptions and illustrations of lathe, drill, planer, boring mill, and other chucks, face plate jaws, air-operated wrenchless chucks, and assembling stands. Vises for use on the shaper and milling machine are also included. A copy of this catalog will be sent to any mechanical executive without charge.

Erratum

The July issue of Modern Machine Shop contained a description of a "Mechanical Engine Mover," by Jos. C. Coyle, which was stated to have been developed in the shops of the D. & R. G. Railway. This statement was in error. The machine described was developed by Mr. J. B. Irwin, Superintendent of the Denver Shops of the C. B. & Q. Railroad, who holds the patent.



MODERN GRINDERS

— capable operators — both are handicapped by dull or glazed grinding wheels. The Desmond Ball-Bearing Dresser is a practical substitute for Diamond Dressers. It is designed for precision work. *Send for catalog M.*

The DESMOND-STEPHAN MFG. CO., URBANA, OHIO

"C" CLAMPS

Electric Steel *for* Long Service

Made in seven sizes, opening from 3 to 12 inches.

Depth of throat 2½ in. on all sizes.

Write for catalogue No. 80, showing Clamps, Lathe Dogs and Expanding Mandrels.

W. G. LECOUNT TOOL WORKS
SOUTH NORWALK, CONN.

ECLIPSE *Combined CORE DRILL and FACER*

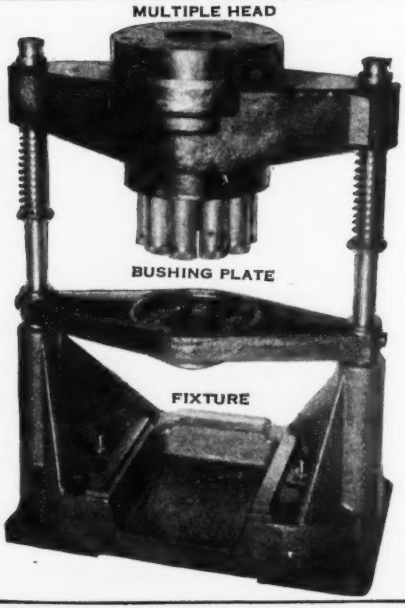
eliminates extra operations. Very economical for machining Welch Plug holes, or for finishing, in one operation, holes having more than one diameter.

Sales Representatives in all large cities.

Catalog No. 28 Upon Request.

The rigid construction, greater chip clearance, and Eclipse drive, insure efficient performance.

ECLIPSE INTERCHANGEABLE COUNTERBORE COMPANY
DETROIT — MICHIGAN



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Multiple Head, Bushing Plate and Fixture } held in positive and perfect alignment for
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OUR SKILLED TOOL ENGINEERS
Will be pleased to furnish complete data and submit quotations on the equipment best suited to your purpose.

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For Your Catalog Library

Check any of these useful publications that you want, write your name, firm name, title, and address on the margin, then tear out the page and send to Modern Machine Shop, 128 Opera Place, Cincinnati, Ohio. They will be forwarded to you promptly without cost or obligation. Please restrict your list to not more than ten.

Abrasive Grinding Wheels: The types of wheels, with recommended grades and grains, which should be used for each of the various kinds of grinds are discussed in a booklet which will be sent free to mechanical executives by the Abrasive Company, Philadelphia, Pa.

Broaching By Modern Methods: Equipment and tools for finishing round, square or irregular-shaped holes and surfaces by broaching are described and illustrated in a booklet that is issued free by the American Broach & Machine Co., Ann Arbor, Michigan.

Ames Dial Gages: The latest types of dial gages for inspection purposes are described in the Ames No. 55 Bulletin, which will be sent free to any machine shop executive. Address B. C. Ames Co., Waltham, Mass.

Scraping By Power: Bearing surfaces can now be scraped with a power scraper that is quicker and easier than the old-fashioned hand method. The tool is described in a folder that is issued by Anderson Bros. Mfg. Co., 1926 Kishwaukee St., Rockford, Ill. Sent free on request.

Steel Furniture for the Shop: The complete line of steel furniture made by the Angle Steel Stool Co., Plainwell, Michigan, including steel stools and chairs, steel foremen's desks, lockers, tables, tool stands, machine tenders, shop boxes and pans, iron bar racks, trucks, bench legs, and bench drawers, is described and illustrated in Catalog "C," which is issued free to machine shop executives.

Stop Tap Breakage: A booklet that tells how to stop the breakage of taps, reamers, and other tools, by the use of a friction chuck, also how to use the chuck for setting studs or nuts, has been issued by The Apex Machine Co., 200 Davis Ave., Dayton, Ohio. Sent free upon request.

Machine Shop Accessories: Catalog B-27, issued by the Armstrong Bros. Tool Co., 328 N. Francisco Ave., Chicago, Ill., describes the line of tool holders, boring tools, wrenches, pipe tools, ratchet drills, lathe dogs, and other tools manufactured by this company.

Metal and Wood Saws: Catalog No. 20 describing saws of all kinds, for both metal and wood. 256 pages of descriptions of saws and sawing machinery. E. C. Atkins & Co., 402 S. Illinois St., Indianapolis, Ind.

Hobs and Milling Cutters: A complete line of milling cutters and hobs for cutting all kinds of gears, splines, sprockets and other forms is described in Catalog G, issued by the Barber-Colman Company, Rockford, Ill. Descriptions and illustrations of the Barber-Colman hobbing machine and hob-sharpening machines are included. Sent free on request.

All-Geared Drilling and Tapping Machines: A catalog describing in detail the various types of all-geared, self-oiling, drilling and tapping machines made by the Barnes Drill Co., 801-851 Chestnut Street, Rockford, Ill., will be sent free upon request.

Modern Drilling Equipment: Circulars describing the various types and sizes of Barnes upright drills, multiple drills and horizontal drilling machines made by this company have been issued by the W. F. & John Barnes Co., Rockford, Ill.

Automatic Oiled Die Sets: The automatic oiled die sets, die shoes, punch holders, leader pins, bolster plates, bushings, and other standard die parts made by the E. A. Baumbach Manfg. Co., 1806 S. Kilbourn Ave., Chicago, Ill., are described in Catalog No. 5, which has been issued by that company. Sent free upon request.

"C-V" Chrome Vanadium Wrenches: A complete line of wrenches made of Chrome Vanadium steel—practically unbreakable—is described in a booklet that has been issued by the Bonney Forge & Tool Works, Allentown, Pa. Copy free upon request.

Bradford Precision Lathes: Precision Lathes for the tool room and for general manufacturing purposes, all-geared and cone types, belt or motor driven, are described and illustrated in a catalog that is issued by The Bradford Machine Tool Co., 657-671 Evans St., Cincinnati, Ohio. The catalog also includes descriptions of taper, relieving, turret and other lathe attachments. Sent free upon request.

Bradford Unit Type Drill Heads and Tapping Heads are described and illustrated in a bulletin published by the Bradford Machine Tool Co., 659 Evans Street, Cincinnati, Ohio. The bulletin also describes useful applications of these heads.

How to Sharpen Cutters: A series of leaflets, which describe and illustrate the correct methods to employ in sharpening all kinds of cutters, can be obtained, without charge, by addressing Brown & Sharpe Mfg. Co., Providence, R. I.

High Speed Drill Presses: A complete line of drill presses that can be run at high speeds with complete safety is described in catalog number 50, issued by the Canedy-Otto Manufacturing Company, Chicago Heights, Ill. This catalog also contains descriptions of other equipment manufactured by this concern. Sent free upon request.

Gear Data: The Cincinnati Gear Co., Cincinnati, Ohio, has published Catalog D, which describes and illustrates the various types and kinds of gears made by this firm. The book contains photographs of the plant departments, with descriptions of the equipment employed, and also includes a number of pages of valuable data and reference tables for machine shop use.

"A Treatise on the Truing and Mounting of Grinding Wheels for Precision Grinding Machines" is the title of a book that has been published for mechanical executives by Cincinnati Grinders, Inc., Cincinnati, Ohio. Copy free upon request.

Giant Automatics with Hydromatic Feed is the title of a book that describes in detail the new type of automatic milling machine with hydraulic feed, which has been developed by The Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio. Copy free to any machine shop executive upon request.

Rapid Traverse Planers: Cincinnati Hypro Planers, made by the Cincinnati Planer Co., Cincinnati, Ohio, are described in a new catalog that has been issued by this company.

Shaper Progress: An illustrated catalog describing the various types of shapers made by the Cincinnati Shaper Co., Cincinnati, Ohio, and including descriptions of Cincinnati Shapers in use in different kinds of plants.

Bolender Gear Burnisher: The latest methods of burnishing gears for accuracy and silence are described in a booklet that has been issued by the City Machine & Tool Works, 5 N. June St., Dayton, Ohio. Copy free upon request.

Handbook For Drillers: The Cleveland Twist Drill Co., 1242 E. Forty-ninth St., Cleveland, Ohio, has published a book in which the various parts of the twist drill are described, and which tells how to grind a drill correctly. The troubles that result from incorrect grinding are described and illustrated and several chapters are devoted to the subjects of speeds, feeds, materials, cutting compounds, and so on. Sent free upon request.

OTHER PUBLICATIONS LISTED ON PAGES 98, 100, AND 102.

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Apex Universal Joints are simple in design, have few parts, made of alloy steel, are much stronger than the ordinary commercial joint.

Joints made to blue prints.

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For nut running in inaccessable places.
For hand or power operations.
With straight shank for welding to hand brace or to fit any portable tool.

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This Chuck can be used either as a Universal or Independent Chuck.

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Rated Size Inches	Will Hold Approximately	Order by These Numbers 3 Jaw	List Price	Order by These Numbers 4 Jaw	List Price
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5	5¾	605 J	59.00	805 J	65.00
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8	8⅝	608 J	80.00	808 J	91.00
9	9½	609 J	88.00	809 J	99.00
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18	18⅜	618 J	195.00	818 J	215.00
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Disc, Expansion and Compression Clutches: The various types of clutches and their uses are discussed in an illustrated booklet that is issued by The Conway Clutch Co., 1959 West Sixth Street, Cincinnati, Ohio.

Die Makers' Supplies: A complete line of die sets, leader pins, bushings, and other die makers' supplies are described in a book that is issued by the Danly Machine Specialties, Inc., 2104 South 52nd Avenue, Chicago, Ill. Sent free upon request.

Davis Keyseaters: Recent developments in keyseating methods are discussed in a bulletin that also describes the keyseaters made by the Davis Keyseater Company, 250 Mill St., Rochester, N. Y. Copy free upon request.

Grinding Wheel Dressers: All of the different types of grinding wheel dressers made by the Desmond-Stephan Mfg. Co., Urbana, Ohio, including Desmond-Huntington, Desmond-Sherman, Zig-Zag, Diamo-Carbo, and diamond dressers, are described and illustrated in a catalog that has been published by the firm mentioned. Free upon request.

Quantity Drilling: A semi-automatic multiple spindle drilling machine which is designed to produce the maximum of drilled holes in medium or small parts, is described in a pamphlet that is published by the Detroit Machine Tool Co., 3055 Woodward Ave., Detroit, Michigan. Sent free upon request.

Interchangeable High Production Tools: Catalog No. 28, issued free by the Eclipse Interchangeable Counterbore Co., 7410 St. Aubin St., Detroit, Michigan, describes and illustrates the interchangeable counterbores, spot facers, end form cutters, and other end cutting tools made by this firm.

Precision Measuring Instruments: The latest types and models of dial indicators, thread lead test gages, pitch gages, thickness gages, dial comparators, and other precision measuring instruments marketed by the Federal Products Corporation, Providence, R. I., are described and illustrated in a book that will be sent free upon application to this firm.

Silent, Self-Lubricating Gears for use in all kinds of machines are described in a booklet that can be had upon application to Fibroc Insulation Company, Valparaiso, Indiana.

Formica Silent Composition Gears: A booklet telling about the uses and advantages of Formica Silent Shock Absorbing Gears, and containing a considerable amount of valuable data with rules and tables for laying out, cutting and using gears. Sent free by Formica Insulation Co., 4632 Spring Grove Avenue, Cincinnati, Ohio.

Fosdick Drills: This publication gives details as to the design and construction of Fosdick Radial, Upright, and Sensitive Drills. Published by the Fosdick Machine Tool Co., Cincinnati, Ohio.

Quick-Acting Clamp: A bulletin describing the "Rapid" drop-forged steel clamp manufactured by the Fountain Equipment & Mfg. Co., 2025 Elm St., Cincinnati, Ohio, has been issued by this firm.

Modern Grinding Equipment: The complete line of universal tool and cutter grinders, surface grinders, drill grinders, tap grinders, and other grinding machines made by the Gallmeyer & Livingston Co., 336 Straight St., S. W., Grand Rapids, Michigan, is described in a series of bulletins that have been issued by this firm. Free upon request.

Flat Surface Grinding: Automatic, semi-automatic, and single-purpose machines for performing all kinds of grinding operations on flat surfaces are described and illustrated in a book that has been issued by the Gardner Machine Company, Beloit, Wis. Copy free upon application.

Adjustable Blade Cutters: Hollow mills, facing tools, face mills, milling cutters and other production tools with adjustable, interchangeable blades are described and illustrated in a booklet that is issued free by the Genesee Manufacturing Co., 141 N. Water St., Rochester, N. Y.

Precision Horizontal Boring, Drilling and Milling: The Giddings & Lewis Machine Tool Co., Fond du Lac, Wis., has issued a series of bulletins describing the various kinds of horizontal boring, drilling and milling operations which may be performed with the machines made by this company. Copy free upon request.

1500 Good Tools: The 1500 tools of various kinds that are made by the Goodell-Pratt Company, Greenfield, Mass., are described and illustrated in a Tool Handbook that has been issued by this firm. Copy free upon request.

Greaves-Klusman Lathes: A book containing complete descriptions of the latest types of lathes made by this firm has been issued by the Greaves-Klusman Tool Co., Oakley, Cincinnati, Ohio.

Air Is Your Best Helper: Air will operate your presses, chucks, vise jaws, and other tools more efficiently and at less cost. Catalog MS-11, issued by the Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago, Ill., will show you how it is done. Ask for a copy.

Grinding, Polishing and Buffing Machines of the latest types are described and illustrated in a series of bulletins that have been issued by the Hammond Machinery Builders, Kalamazoo, Mich. Copies free upon request.

Drilling and Grinding Electrically: Catalog M, showing and describing a variety of modern electric portable drills, grinders, and other tools, including floor grinders and buffers, has been issued by The Hisey-Wolf Machine Co., Colerain and Marshall Sts., Cincinnati, Ohio.

"Quick-As-Wink" Buffing Wheels that eliminate all disadvantages of rag-buffs, speed output, do better work, and cut buffing costs to the minimum are described in a bulletin that is issued free by C. B. Hunt & Son, 639 McKinley Ave., Salem, Ohio.

"Do It Electrically": The complete line of "Thor" universal electric tools, including tools for drilling, reaming, screw-driving, tapping, nut-setting, grinding, and for performing other operations is described in Catalog No. 17, issued free by the Independent Pneumatic Tool Co., 236 S. Jefferson St., Chicago, Ill.

Special Mil-Waukee-Mits of Standard Units: A milling machine of which the base, heads, columns, and other parts are built in standard units, thus enabling the user to order a machine that will be especially adapted for his job, is described and illustrated in Catalog No. 36, issued by the Kearney & Trecker Corporation, Milwaukee, Wis. Free to machine shop executives.

Standardized Jigs and Fixtures: Information concerning standardized jigs and fixtures, also all kinds of special equipment for production, can be had by writing to H. R. Krueger & Co., 439 East Fort St., Detroit, Mich.

Cutter and Tool Grinding: A book that tells how to grind tools and cutters accurately and which also describes and illustrates the different types of LeBlond Universal Tool Room Grinders will be sent free upon request. Address, The R. K. LeBlond Machine Tool Co., Cincinnati, Ohio.

Lathe Dogs and C Clamps are described and illustrated in Catalog No. 80, issued by the W. G. LeCount Tool Works, South Norwalk, Conn. Copy free upon request.

Air-Operated Work-Holding Devices: A booklet showing how air-operated chucks and devices of various kinds can be applied to different kinds of machines to save time and labor has been issued by The Logansport Machine Co., Logansport, Ind.

Rapid-Reading Micrometer: A new type of rapid-reading micrometer, designed to show the reading in numerals, is described in Catalog No. 5, issued by The Lufkin Rule Co., Saginaw, Michigan. The catalog also contains descriptions of the micrometers, calipers, gauges, scales, squares, bevel protractors, and other tools made by this company. Free upon request.

Time Saving Machine Equipment: How machining time can be reduced to the minimum by the use of Wizard chucks, collets and tap holders, turret tool posts, self-centering steadyrests, and other McCrosky equipment is told in a book that is issued by the McCrosky Tool Corporation, Meadville, Penna. Will be sent without charge.

Internal Grinding: The latest methods of grinding internal surfaces with speed and precision are described

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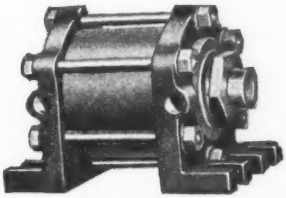

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and illustrated in literature issued by the Micro Machine Company, Bettendorf, Iowa, builders of Micro Grinders. Copies free upon request.

An Outline of Economical Small Drilling: The subject of small-hole drilling is discussed in a booklet that is published by Adolph Muehlmatt, Fifth and Elm Sts., S. E., Cincinnati, Ohio. The booklet also describes the outstanding features in the construction of the A. M. Sensitive Drilling Machine.

Automatic Tapping and Threading Tools of the latest types and designs are illustrated and described in Catalog No. 25, which has been issued by the Murchey Machine & Tool Co., 951 Porter St., Detroit, Mich. Copy free upon request.

"The 'Hole' Story In One Word" is the title of a publication that has been issued by The National Automatic Tool Co., Richmond, Ind. The book gives details as to construction and uses of "Natco" multiple drilling and tapping machines.

Milling Internal Keyways: A simple method of milling keyways in gears, wheel hubs, and other similar parts with the aid of a drill press and a special tool is explained in a booklet that is published by the National Machine Tool Co., 2271 Spring Grove Ave., Cincinnati, Ohio.

Save Time with Expanding Mandrels: How expanding mandrels will solve the problem of turning pieces with odd-size holes, and will increase production on duplicate work, is told in a folder that will be sent free upon request by W. H. Nicholson & Son, 136 Oregon St., Wilkes-Barre, Pa.

Live Centers: The complete line of live centers manufactured by Nielsen, Inc., of Lawton, Mich., are fully described in a bulletin issued by this company. This bulletin is illustrated with photographs and blueprints of the Nielsen Center. Mailed free upon request.

Ball and Roller Bearing Data Sheets: A complete set of data sheets showing all the dimensions and loads at given speeds, and giving instructions for mounting precision ball bearing and Hoffmann roller bearings, can be obtained without charge by addressing the Norma-Hoffmann Bearings Corporation, Stamford, Conn.

Grinding Wheel Information: A booklet which tells how grinding wheels are made and graded, and which give instructions for mounting wheels, operating speeds for different kinds of work, instructions for truing and dressing, and other information has been issued by the Norton Company, Worcester, Mass. Sent free upon request.

Correct Cutter Grinding: How cutter costs can be reduced and more production per grind of cutter obtained is told in Booklet "E," published by The Oesterlein Machine Co., 3319 Colerain Ave., Cincinnati, Ohio. Sent free upon request.

Die Making Machines: How dies, templates, gages, etc., can be sawed out, filed, and lapped easily and accurately on Oliver die making machines is fully described in a bulletin issued by the Oliver Instrument Company, 1430 Maumee Street, Adrian, Mich. Mailed upon request.

Self-Tapping Sheet Metal Screws: Screws which are threaded and hardened in such a manner as to enable them to cut their own threads as they are screwed into sheet metal assemblies are described in a folder which is published by the Parker-Kalon Corporation, 192-196 Varick St., New York City., N. Y. Sent free upon request.

Tapping Devices, Quick-Change Chucks, Stud-Setting Tools and Bench Tappers: A catalog describing the various types and kinds of tapping, drilling, and stud-setting devices manufactured by the Procunier Safety Chuck Company, 12 South Clinton Street, Chicago, Ill., can be obtained without charge by addressing this company. The catalog also tells the part that Procunier tools play in obtaining greater accuracy and less tap breakage.

Pullmore Industrial Clutch: A multiple disc clutch, made in two types, to run in oil or dry, and which is so built that it can be operated at high speeds, is illustrated and described in a folder that will be sent free by the Rockford Drilling Machine Company, Rockford, Ill.

Engine, Turret, and Gap Lathes are described in a series of bulletins that have been issued by The Hahn-Larmon Co., 2935 Spring Grove Ave., Cincinnati, Ohio.

Universal Openside Shaper-Planer: The need of a machine tool to fill the gap between the shaper and the planer has been filled by the development of the Rockford Universal Openside Shaper-Planer, made by the Rockford Machine Tool Co., 2414 Kishwaukee Ave., Rockford, Ill. Full description on request.

Automatic Lubrication: Individually motor-driven pumps that keep the work flooded with lubricant are described in a booklet that has been published by the Ruthman Machinery Co., Front and Pike Sts., Cincinnati, Ohio.

Safety Grinding Wheels: The complete line of grinding wheels made by the Safety Grinding Wheel & Machine Co., Springfield, Ohio, is described in Catalog No. 11, which is issued by this firm. The book also contains instructions for operating grinding wheels, tables of grinding wheel speeds, pulley calculations, and other information for the user of grinding wheels.

Patent Your Inventions: Full particulars can be had without charge by addressing Lester L. Sargent, 1115 K St., N. W., Washington, D. C.

Saving Time With Small Tools: A line of time-saving small tools, including "Use-'Em-Up" drill sleeve, "Wear-ever" chucks, collets, cutters, reamers and tap holders, counterbores, spotfacers, and other tools is described in Catalog 36, issued by Scully-Jones & Co., 1909 S. Rockwell St., Chicago, Ill.

Equipment For the Shop: Vises for the bench, drill press, milling machine or shaper; angle plates; adjustable clamps, jacks and other tools for the machine shop, are described and illustrated in a booklet that is published by the Sheldon Machine Co., 3253-55 Cottage Grove Ave., Chicago, Il. Copy free upon request.

"Metal Cutting" is the title of the book that describes the latest methods of cutting metals, and includes descriptions and illustrations of both the band saws and inserted-tooth metal-cutting saws made by the Simonds Saws & Steel Co., Fitchburg, Mass. Copy will be sent free upon application to the firm mentioned.

"Chucks and Their Uses" is the name of a book which contains a full description of the different kinds of chucks and suggestions for the proper care of chucks, and tells how chucks should be fitted to lathes. It also contains a number of suggestions for general shop practice. Sent free upon application by The Skinner Chuck Co., New Britain, Conn.

Shaping with Modern Equipment: The Smith & Mills Company, 2889-91 Spring Grove Avenue, Cincinnati, Ohio, has issued a booklet which describes and illustrates the line of modern shaping equipment made by this firm. Copy free upon request.

Cutting Oil Data: A series of booklets containing valuable information about cutting oils and their uses for thread-cutting, broaching, and general cutting purposes will be sent free to any mechanical executive by D. A. Stuart & Co., 2727 South Troy St., Chicago, Illinois.

Engineering and Manufacturing Service: A complete engineering and manufacturing service for manufacturers who are not equipped to handle all of their own designing, experimental, or production work is described, with illustrations of the equipment available, in a bulletin that is issued by The Steel Products Engineering Co., Springfield, Ohio.

Cutting and Grinding Facts: A discussion of cutting oils and lubricants, together with descriptions and illustrations of various kinds of jobs upon which cutting oils are used, is contained in a booklet that is issued by the Sun Oil Company, Finance Building, Pittsburgh, Pa. Free upon request.

OTHER PUBLICATIONS LISTED ON PAGES 96, 98, AND 102.

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You can be sure of prompt delivery, fair prices and high quality when you order forgings for piston rods, clutch shafts, lathe spindles, rams, hydraulic cylinders, etc., from us. Send prints for estimate.

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is recommended for broaching connecting rods and work that comes within the 2-ton range. We manufacture presses from 2 tons to 150 tons pressure, also all types of broaching tools.

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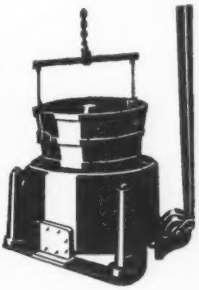
Tolhurst 40" and 48" chip wringers handle long curly turnings as readily as fine chips—reclaim more oil and reduce labor cost to an optimistic minimum.

A 40" Tolhurst handles more work than several small machines and four 48" Tolhursts will reclaim 1,800 gallons or more of oil per day.



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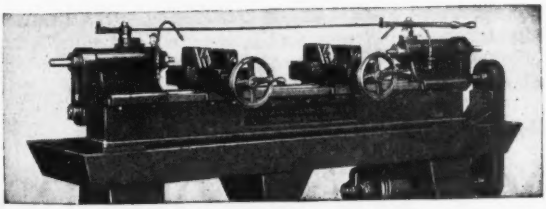

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Double End Centering Machine

For centering both ends of a shaft simultaneously. Spindles operate together or independently. L. H. head is removable for long shafts. Accommodates a wide variety of work. Special fixtures furnished when desired. Send for Bulletin.

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Flexible Shaft Equipment: The uses of the flexible shaft for drilling, grinding, and other operations is discussed in a booklet which also describes and illustrates the flexible shaft equipment made by N. A. Strand & Co., 5001 N. Lincoln St., Chicago, Ill.

Rigidmilling Principles and Practice: A book that shows how the Rigidmil can be adapted to various kinds of usual and unusual milling operations, and which describes in detail the work that can be handled by this machine has been issued by the Sundstrand Machine Tool Co., Rockford, Ill. Copy free upon request.

Quality Drilling Machines: The high-grade drilling and tapping machines made by the Superior Machine Tool Co., P. O. Box 376, Kokomo, Ind., are described and illustrated in a booklet that will be sent free upon application to this firm.

Precision Measuring Instruments: The gages, micrometers, and other precision measuring instruments made by the Swedish Gage Co. of America, 7310 Woodward Ave., Detroit, Mich., are fully described in an interesting booklet that has been published by this firm. Copy free upon request.

Save Cutting Oil: How cutting oil can be separated from chips and thus reclaimed by the use of a centrifugal chip "wringer," is told in a bulletin that is issued free by the Tolhurst Machine Works, Troy, N. Y.

Chuck With Air: How time and labor can be saved by the use of air-operated chucks, cylinders, and other equipment is told in a book which describes "Hopkins" Air-Operated Equipment. Published by The Tomkins-Johnson Company, 620 N. Mechanic St., Jackson, Mich. Sent free upon request.

A Simplified and Improved Drive Control for Machinery: Two distinct types of plate clutches that have proved successful highly in the driving mechanism of machine tools are described and illustrated in a bulletin that will be sent free by the Twin Disc Clutch Company, Racine, Wis.

Powerful, Easy-Acting Chain Hoists of the most modern design are described and illustrated in a booklet that is issued by the Union Manufacturing Co., 298 Church St., New Britain, Conn. Copy free upon request.

Multiple Drilling With a Single-Spindle Drill: Methods by which multiple drilling may be done on a single-spindle drill, using multiple spindle drill heads, are discussed in a bulletin that is issued by The United States Drill Head Co., 1954 Riverside Drive, Cincinnati.

Electrically-Driven Portable Tools: The "U. S." line of electric drills, die grinders, electric screw drivers, surface grinders, tool post grinders, and bench and floor grinders is described in Catalog No. 24, which has been published by The United States Electrical Tool Co., 2471 W. Sixth St., Cincinnati, Ohio.

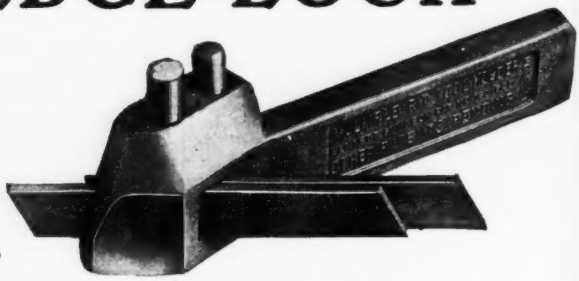
Hardness-Testing With Accuracy and Speed: The principles of testing for hardness by the use of the Rockwell Hardness Tester are discussed in a booklet which also shows a number of applications of this instrument, published by the Wilson-Maeulen Co., Concord Ave. and 143rd St., New York, N. Y. Sent free upon request.

Tool Chests for Machinists and Toolmakers: The complete line of fine tool chests for machinists and toolmakers made by J. M. Waterston, 420 Woodward Ave., Detroit, Mich., is described in Catalog No. 25. Ask for it.

OTHER PUBLICATIONS LISTED ON PAGES 96, 98, AND 100.

WEDGE-LOCK

The Multiple Bit Tool Holder...



...requires less time for changing tools than any other method. A light tap on the rear pin releases the tool immediately which can be drawn from the holder without backing the carriage from the work. A new tool is inserted and a tap on the front pin securely locks the tool — holding it absolutely rigid — ready to cut.

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With the "Procunier" Safety Friction Device blind holes can be tapped just as easily as through holes, and without danger of breakage.

Don't Hesitate To Ask For a Free Trial

Catalogue 102-C gives complete details of "PROCUNIER" Tapping Devices, Quick Change Chucks, Stud Setters and Bench Tapping Machines.

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FLEXIBLE SHAFTS AND MACHINES
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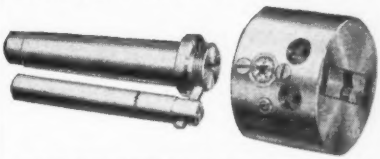

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For almost every testing and measuring requirement—Precision Instruments for laboratory use—Upright Dial Gauges—Thickness Gauges—Dial Gauge Heads—Pocket Gauges—Comparators.

Precision with speed and extreme accuracy.

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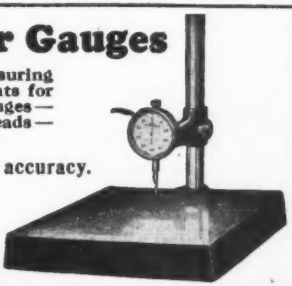

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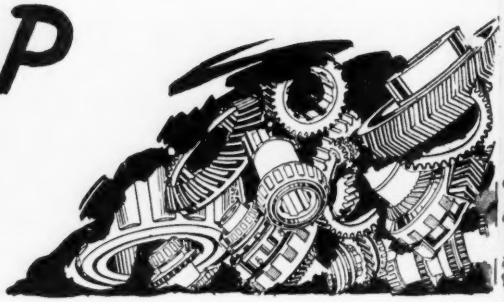

By Geo. Alexander Mann

Teeth ache 'cause they got holes in 'em—which explains many a head-'ache.

Aw Hush

So sentimental is Autumn,
It makes the whole world akin,
Not exceptin' the jiggers—
Even they get under my skin.

The talkies make us wish the movie stars were as dumb as we thought they were.

A Honest Confesh

"I would like to see
A good used car," said Si.
The salesman smiled an' said,
"Believe me—so would I!"

That'd Be Tuff

Wouldn't ut be awful for an election in Chicago to come out a tie an' have to be shot all over again?

"The milk is blue,"
Dumb Liz commented,
"Because the cows
Are discontented."

Many a dad thinks his son is a big gun at school until he gets his reports.

Doc's Mistake

"I won't take this tonic,
Of nerve Doc's got a lot—
It says it's for adults,
An' that ain't what I got.

From what we've seen o' pok wouldst say an appropriate them song would be "Over the Boundin Mane."

Poor Sap

With Violet in his arms,
He drove his car—poor silly—
Where once he held a violet,
He's now holding a lily.

Many a divorced wife would like to have her husband back, but she can't afford him.

An' That's Somethin'

It's just as well for father an' son to be buddies an' promise each other not to tell mother everything—it prevents double exposure.

Ain't Ut Pitiful?

As a babe he's a beautiful tad,
An' later a fine, handsome lad;
Then of "mother's delight"
They say, "ain't he a sight?"
As he grows up to look like his dad.